"Let Knowledge grow from more to more."—TENNYSON.

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THE STREAM OF LIFE.

AMONG the results of modern, nay, of quite recent, scientific research, I know none more impressive than the recognition of the stream of life, animal and vegetable, which has flowed over the earth during millions of past years. Starting we know not how, coming we know not whence, the stream of life has left traces of its existence in all the rock strata of the earth from the palæozoic onward through the secondary and tertiary systems, onward to the pleistocene and to those strata which are called recent, though some of them, measuring their duration as men measure time in considering the progress of races and of nations, seem of vast antiquity.

Let us consider how the history runs, not entering into details, but taking such a survey as shall bring the broad features of the scene before us, and show its cosmical rather than its merely terrestrial aspect.

How first the earth's crust was formed we know not, for the traces of the first formative processes have long since been swept away. Probably each portion was formed again and again, solidifying and melting, and resolidifying and remelting, many times over before it finally assumed the solid condition. In some cases the solid part of the crust, being of greater specific gravity than the molten, would sink as fast as formed, to melt again, and again return to the surface, not finally solidifying in a permanent way until many hundreds of thousands, perhaps millions, of years had passed.

Whether any part of the present crust of the earth can be regarded as representing the solid crust fashioned when first these alternations were completed may well be doubted. The so-called Archæan rocks have been supposed by some to be the primeval crust of the planet. But others regard them as belonging to a much later stage. And others yet admit that we cannot tell what interval separated the formation of these, the most ancient rocks of the present earth, from the first formation of a crust upon that region of the earth where the Archæan rocks are found. But this, at any rate, is certain: Whenever the Archæan rocks, which have been exposed in various parts of the earth by long continued processes of denudation, were actually formed, they have mostly (if not all) undergone great changes during the time that they have been buried beneath strata formed later. Moreover, it must be remembered that the lower primary rocks which were originally deposited on these Archæan rocks were formed from them by processes of denudation, and that, therefore, we cannot expect to find anywhere the ancient face of the first-formed crust. Indeed, denudation in those remote times, certainly 20,000,000, and probably 100,000,000 years ago, was a very much more active process than denudation as it takes place now. For the waters of the ocean were greater by one-half in quantity, were intensely hot, were loaded with destructive acids, were more actively moved; while the air was not the pure life-nourishing air we breathe now, but an atmosphere whose breath was fire, laden with destructive vapours, swept by tremendous storms, and bearing clouds from whose bosom descended torrents of hot water, mixed with sulphuric acid, boracic acid, and other powerfully acting liquids. By these destructive agencies the first formed crust of the earth must have been rapidly denuded, and fresh layers formed at the lower levels, to be raised while the higher levels were depressed, fresh denudation following, and fresh layers being formed, probably during millions of years, before life was possible upon the earth.

It appears to me, indeed, that in the existence of fossil traces of life, animal and vegetable, in the lowest of the palæozoic rocks, we have decisive evidence that immense periods of time must have separated the formation of the rocks next below them from the first formation of the earth's solid crust. For it is certain that during millions of years following the solidification of the earth's crust, life must have been impossible. Even apart, therefore, from the decision of the much-vexed question whether the formation named *Eozoon* found in the Archæan limestones of Canada is to be regarded as the fossil evidence of a reef-building animal (a Foraminifer), which would throw back still farther the time of the first solidification of the crust, we may safely conclude that the Archæan rocks represent formations which had no existence with their present structure until millions of years after the earth first had a solid surface.

With our present ideas respecting the laws of biological evolution (ideas based, be it remembered, on observed facts) we may deduce the same conclusion from the character of the fossils found in the lowest of the primary or palæozoic rocks. We know that whatever may have been the actual beginnings of animal and vegetable life on the earth, the flora and fauna even of the lowest palæozoic strata cannot have come into existence save as the product of immense periods of past time. In the Lower Silurian rocks, indeed, we have but few fossil traces of the vegetation of the remote time when they were formed; but this is chiefly due to the fact that the Lower Silurian rocks are chiefly of marine formation. But the animal life, even of the oldest stratified rocks, suffices to decide the question of duration in the most emphatic manner. Of course, the record is incomplete; but in its very incompleteness it is the more decisive. We find complex and advanced forms, while the simpler forms, which necessarily existed at the same time, have left no trace of their existence. We can understand, then, how all forms of life, simple and complex, animal and vegetable, belonging to earlier strata, have disappeared, leaving no fossil evidence. And the positive evidence given by the fossils we do find, while thus giving to the negative evidence its true meaning, has its own definite and unmistakable value.

If we consider, for example, but a single class—say the Trilobites (now extinct, though transiently represented in the early life stages of the King Crab)—we have as decisive evidence of enormous preceding time-intervals as if we had fossils of 10,000 species of Silurian life, animal and vegetable. Those strange crustaceans existed at the remotest time to which geological history looks back, in many different forms. Each had a strong head-shield to protect its head, a smaller tail-shield, and a ringed body which could be so curled that the two shields came together, and the whole body was protected. Some were nearly two feet in length (possibly some were much larger, but I speak

only of existent fossil evidence), and from this size they ranged down to minute forms, such as the *Agnostus Princeps*, which was less than half an inch long. The number of rings also varied, the *Agnostus* having but two, the *Microdiscus* four, the *Erinnys* no fewer than twenty-four. Still more striking evidence of development, requiring hundreds of thousands of years for its full work, is found in the complex eyes of the more advanced species of trilobites, for while the *Agnostus* was blind, most of the trilobites had eyes, some with fourteen facets, others with as many as 15,000! All through the Silurian period these crustaceans continued to thrive and multiply and develop into varied forms. But as the millions of years represented by the palæozoic strata passed on, evolution in the race of trilobites resulted in the development of other races better fitted for the changed conditions of life; we find no traces of any trilobites later than the carboniferous age; and in that age we find only four, all of which were small. Doubtless many others existed of which no fossil traces have been left. Doubtless, also, trilobites continued to much later times than the fossil evidence attests.

We cannot trace the series of crustacean races which connect the trilobites with their descendants in secondary, tertiary, and recent ages. We cannot even tell what creatures have descended from the trilobites, excepting here and there a race or so, or along what line the descent travelled. We know only that those races which retained their trilobitic characteristics died out, those only surviving which adapted themselves by changes of structure to surrounding conditions.

But the Silurian rocks (the lowest and most ancient of all rocks known to have been life-bearing) were not without vegetable life, and the fossils telling us of the existence of vegetable life show also that immense periods of life must already have passed before that life began. In the Upper Silurian strata we recognise the spores and stems of flowerless plants (*cryptogams*). Club mosses and ferns were particularly conspicuous in the flora of those palæozoic times. "We can dimly picture the Silurian land," says Geikie, "with its waving thickets of fern, above which lycopod trees raised their fluted and starred stems, threw out their scaly, moss-like branches, and shed their spiky cones." But it is only because the cones and spore cases of the club mosses and the tough tissues of the ferns have been well fitted to withstand destructive agencies, and so have remained in fossil form (some few even of these), that we are able to speak of these as forming characteristic features of the old Silurian thickets. Doubtless many other forms of vegetable life existed, whose traces have long since entirely disappeared. The wonder is, considering the immense remoteness of Silurian time, that any trace whatsoever, either of animal or vegetable life, should have reached our time.

Most strange is it to think that even of the denizens of those ancient thickets some traces have been found. Remains of scorpions were discovered in the Silurian rocks of Sweden, Scotland, and the United States almost simultaneously in 1884; while in those of France, also in 1884, the remains of an ancient cockroach were found. Where scorpions and cockroaches abounded, not only must there have been many other forms of land animals, but animal life must have existed on land during hundreds of thousands of years. For the laws of biological evolution do not permit us to believe in the development of living creatures so complicated in structure as the *Arachnidæ* and the *Blattidæ*, save in vast periods of time.

In these early stages of palæozoic time we find evidence not only of multitudinous life, but of many forms of life. Still within the Silurian era we find vertebrate forms in fishes akin to the modern sharks, the sturgeon, and the garpike. (The catfish shares with the cockroach the honour of descent from Silurian times.) Onward through Devonian time vertebrate life presents itself still only among fishes, but now in ever increasing variety and numbers. New forms of crustaceans—the Eurypterids—having affinities also with the Arachnidæ (scorpions), began to replace the trilobites, from which probably they had descended, though after transformations requiring vast periods of time.

Many other forms of life existed also throughout the Devonian period, while an abundant vegetation spread over the land, traces of no fewer than a hundred different species of plants having been discovered in the Old Red Sandstone. True conifers now began to appear, or at least fossil races of such trees are for the first time recognised in Devonian rocks.

The forests must have been uniformly green, for millions of years were to pass before deciduous trees were to appear. Many forms of insect life existed in those overgreen forests; fossil wings of insects have been found which seem even to indicate by their size an exceptional wealth of insect life; for races attain large size only under favourable conditions. Thus among several forms of May Fly we find one whose wings must have had a spread of fully five inches! Strange, be it noted in passing, to find traces thus ancient certainly not less than 20,000,000 of years old, of a creature whose very name—the *Ephemeron* naturalists call it—means the creature of an hour, so short is its actual life, so slight its seeming hold upon existence.

But now for the purpose of the sketch here planned we need no longer consider the details of the progress and development of life. We have thus far considered these because they serve to show how far back, beyond the time even when the oldest rocks were forming, we must throw the beginning of life upon our earth. But so soon as we have recognised this, so soon as we have understood that periods to be measured by hundreds of thousands, if not by millions of years, must have passed while the fauna and flora of even the Silurian rocks were being developed, we can pass onwards over stage after stage of the earth's life, noting how during every stage multitudinous forms of animal and vegetable life existed. Some forms were as yet in the first stages of development, others fully formed, others highly developed, and others already approaching the time when, having outlasted their proper era, they were about to disappear. In disappearing they left the field open to kindred races not descended from them but from the same progenitors, having, however, been saved from extinction by such changes as fitted them for their environment.

In this sense one may compare the various forms of life, animal and vegetable, to the various individual representatives of that form, among whom we recognise at one and the same time the infant, the young, the middle-aged, the old, and those nearing death. For species and genera as well as individuals have their inception, their growth, their full vigour, their decay, and finally their death; though because the periods of time necessary for the full development and the eventual decay of a race are so long that the lifetime of an individual (even of a longer-lasting type) is usually but a second by comparison, we are apt to imagine permanence where in reality there is only relatively long-lasting development and dissolution.

It has been because of this that men have so long been led to imagine that races of plants and animals can be neither developed nor destroyed, that all races must have had their beginning in a process of direct creation, and can only have their ending through a process of catastrophic destruction. Even when geologists began to recognise the enormous duration not only of the so-called primary,

secondary, and tertiary eras, but of the different systems included in each, they still supposed that the fauna and flora of one era were destroyed before another era began, those of the new era being specially created.

At length, however, the great law of biological evolution was discovered, which shows how genera, species, and varieties undergo modifications fitting them for their surroundings, modifications individually small but eventually capable of changing (*when necessary**) the whole character of the plant or animal so developing—those races which do not duly develop when change is required eventually dying out.

Then science began to see that neither creation nor catastrophe is required to explain the life-history of the earth. Precisely as the geologist sees in processes such as are taking place now the explanation of all those features of the earth, ocean and continent, mountain range and river channel, hills and valleys, ravines and chasms, which in old times had been explained by processes of catastrophic intensity of action, so now the biologist recognises in all the forms of vegetable and animal life, infinitely varied though they are, the product of processes of biological evolution such as we can see in action at this present time, though possibly in the lifetime of a man, or even of a race of men, they may produce scarce discernible changes.

(To be continued.)

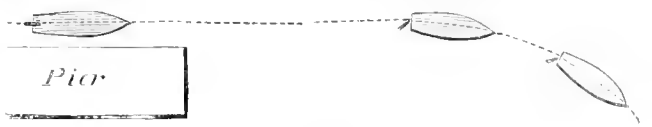
COLLISIONS AT SEA.

By GILBERT R. FAITH.

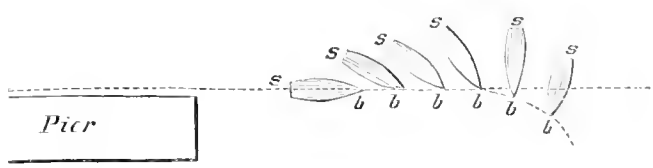
ACTION OF THE RUDDER UPON STEAM AND SAILING VESSELS.

MANY years ago I had occasion to make a voyage from Halifax, N.S., to Bermuda. The vessel was the Cunarder *Merlin*, and her commander the "commodore" of the Bermuda, West Indian, and Newfoundland line. We left the pier about midnight, and a very dirty night it was. Something very like a gale from E.N.E. was blowing, with fitful storms of rain. We made a good start, however, and in an hour and a half had steamed past Sambro' light, some twelve or fourteen miles from Halifax, and the dangerous stony-hearted group "The Sisters," with whom mariners care not to have even a bowing acquaintance (no pun intended), were holding their storm-revels not far way. From the time of leaving the wharf I had remained in shelter from the rain under the main companion, smoking and enjoying the scene, if scene could be called what was dimly visible on so dark a night. Suddenly a rush of feet on deck, an excited outcry, and then a tremendous crash on our starboard side. Simultaneously an immense white spectral object loomed high above us, and instantly vanished astern into the darkness, while down upon the stout hatchway, the half dome beneath which I stood, rattled blocks and broken rigging. It was the work of a moment to jump on deck, and of little more to kick off my boots, for I thought from the shock that we must founder, and was determined to make as good a fight of it as possible. A glance round showed that the starboard bulwarks had been swept away from about amidships, and with them boats and a deckhouse, while the starboard stays of the smoke-stack had disappeared, and the main and mizzen shrouds and backstays swung in against the masts. Some minutes passed before I was able to get a word with one of the junior officers, when I learnt that the ship had not sustained any serious damage, and that the injuries she had received were all above board. "What was it that struck us?" I asked. He replied, "A large square rigged vessel; she bore down straight upon us under as much sail as she could carry; the beggar carried no lights; but just as we struck, I saw a fellow jump into the bows with a lantern." After I had with some difficulty recovered my discarded boots in the darkness, I walked aft on to the quarter-deck and found the captain near the wheel. "A pretty close shave that, Captain S.," I said. "Yes," he answered quietly and seriously, "*but if I had followed the sailing instructions we should not be here now to talk about it.*" It was not my province to ask him to explain, but I felt that at a critical moment his thorough seamanship had inspired him to do something which contravened official orders for such emergencies, but had saved our lives. I have since been enabled to form an opinion as to what the gallant little captain did do, and proceed to relate another incident, which will perhaps enable the reader, if interested, to do so too.

Several years after the adventure narrated above I was standing on the pier at Halifax seeing off some friends on the Cunarder *Alpha*. As the steamer shot out into the stream a friend who stood near me (a shipowner himself, much interested in matters of navigation, and a keen observer to boot) remarked, "G——, what course will that steamer take when her helm is put a-port?" I answered, "Why, surely there can be no doubt about it: her head will come round in the other direction." "No, it will not," he said. "Her course will be very soon changed to that direction; but you will find that it is the stern of the vessel which will be deflected to the left, and not the bow which moves round in the direction you suppose. Now take a line along that ship to the white house on the opposite shore, and note the movement." I did so; and surrendered my opinion at once, for he was right. The following diagrams will illustrate my observation:—No. I is the line



No. 1.



No. 2.

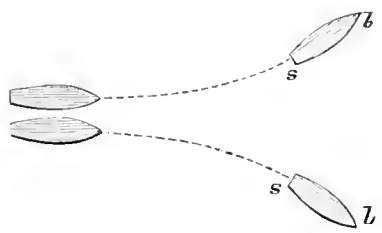
which I was confident the ship would follow; No. 2 suggests the deflection which I actually saw.

Now my preconceived idea of the movement of a vessel when the helm is put up or down is, so far as my observation goes, the universal belief. If this is so, what a fruitful source of collisions! In the hope of eliciting a discussion which may throw light upon this important matter and lead to beneficial results, I have written the present article.

* I emphasize this because some opponents of the doctrine of evolution imagine they have fully met the arguments of the believers in evolution, when they have shown that in some cases races have remained unchanged for thousands of years. This may happen—aye, and much longer periods of changelessness—where the conditions have not changed. The Catfish has outlasted tens of thousands of races worthier, it might have seemed, of long continuance.

Some ten years ago (if my memory serves) occurred the disastrous collision between the *Grosser Kurfürst* and the *König Wilhelm*. The facts of this catastrophe prove, as it seems to me, the principle above stated, and the ignorance of the commanding officers in regard to it. The two vessels in question had in the course of manœuvring got into dangerous proximity while steaming parallel to each other, and orders were given to sheer off and separate, the belief being that, if one helm were put down and the other up, the vessels would diverge in regular curves. What actually occurred was that the sterns of the two vessels approached each other until the collision occurred, which resulted in the sinking of the weaker vessel, and the drowning of the greater part of her crew. In the inquiry which was made into the cause of this disaster the officers of both ships were pronounced free of blame, and it was determined to institute a course of experiments to ascertain how the vessels could have come into contact while efforts were being made to separate them. I have never heard what the result of the experiments was, and do not think that it was published.

To illustrate by a diagram. No. 1 represents the intended



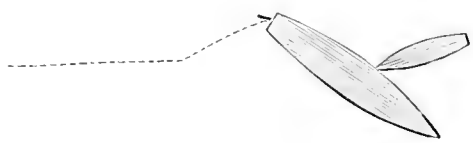
No. 1.

No. 2.

course of the two ships when separating; No. 2 represents their actual course.

Not long after the preceding catastrophe occurred the following collision, which must be well remembered. Two Sound (Long Island Sound, U.S.A.) steamers of the same line, the *Stonington* and *Narragansett*, were proceeding to their destinations. They had been accustomed to pass each other midway of the route for years, but on this occasion they proved to be approaching each other too directly. The rule of the road was followed on this occasion. Each vessel obeyed the sailing instructions, as was afterwards admitted. If these were adapted to such cases the vessels should have cleared each other. But they were approaching head-on with great speed; there was not sufficient interval to allow for the stern deflection, and they were brought into collision with such violence that one sank with the loss of many lives. The newspapers commented upon this collision as inexplicable because the sunk steamer was struck upon the reverse side to what would have been expected, which fact is easily explained upon my hypothesis. It was, I believe, by ordering the helms of the *Merlin* in a sense directly opposed to the published instructions that Captain S. so deflected the after part of his ship in the few moments allowed to him as to receive a glancing instead of a direct blow.

As a last illustration, I will instance the loss of the fine steamer *Oregon*. The facts in this case are unfortunately not very clearly known, but it is generally admitted that she was sunk by a vessel approaching her obliquely from the port side, which in the fog had got too near to be avoided. It seems to me possible that the collision was owing again to the following of sailing directions, based upon ignorance of the principle I am seeking to establish. Diagram No. 1



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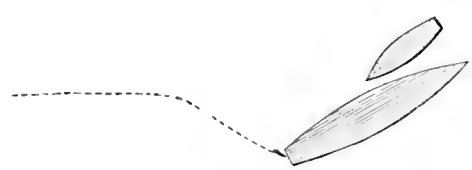
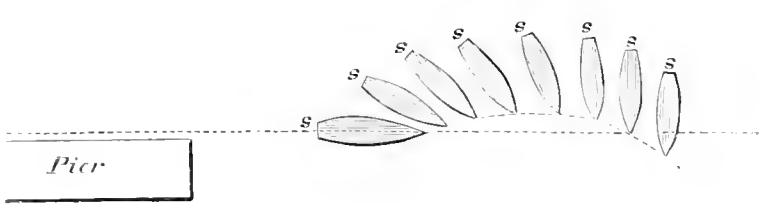


No. 2.

shows my idea of what actually happened, No. 2 what might have happened if the instructions had been directly disobeyed; had the vessels then struck, it would have been a glancing blow, which would not have seriously injured the steamer.

It is to be hoped that a series of experiments as to the amount of this deflection and its relation to the length, draught, and speed of the vessel might result (if it is not presumptuous in a landsman to say so) in a modification of the sailing instructions for such critical cases as I have above instanced, as may avert collisions arising from similar causes in the future.

Since a conversation on this subject here incited by the accounts of two quite recent collisions of English ironclads, a friend informs me that he has observed a steamboat leaving a wharf in Toronto Bay, which he carefully lined by means of a stationary object on the island opposite. The boat was steaming directly away from him at five or six knots, when the helm was ported, and he saw that the *whole vessel* was deflected to the left side of the line on which she had been travelling, and that it was some seconds after the helm had been ported before her bows crossed that line. Thus:—



WATCHED BY THE DEAD.*

IN an essay on "A Novelist's Favourite Theme,"† the present writer has shown that in all Dickens's novels except "Oliver Twist" ("Pickwick" was not a novel), he presented the picture of a villain or a hypocrite, watched by one whom he despised or regarded lightly, but by whom he was eventually brought to justice. We might even have included "Oliver Twist," if it be considered how little either Sikes or Fagin suspect the watch by which Nancy defeats the projects of the craftier villain and of his dupe Monks. However, the theme is so repeatedly worked into the plots of Dickens's chief works that it was hardly necessary to note a slighter use of it such as this, except by way of showing that the whole series of stories, long and short, is thus accounted for. No one can doubt, we think, after he has examined all the evidence collected in the mentioned essay, that there was something enthralling for Dickens in this thought of a steadfast watch by an unseen or unnoted enemy, a constant danger lurking where no danger at all was suspected.

It will have been noticed further, by those who followed us through the survey of Dickens's works in search for this theme, that repeated reference was made to the use of Dickens's favourite idea in his last, but unfinished, work. There, it seems to us, the theme was to have been introduced in its most striking form, in that form which Dickens himself had mentioned in "Martin Chuzzlewit" as most terrible to think of. Dickens had pictured in his latest completed novel a man supposed to be murdered, but really alive, and watching the associates of the dead murderer of the man mistaken for him; and therein he had come very near to the idea he had pictured as the most terrible of all forms of his favourite theme. How he had enjoyed this embodiment of his theme one sees in reading the scene where the inspector proposes to arrest Harmon as an accessory in his own supposed murder. Of all the strange experiences Mr. Inspector had had, that he admits was the strangest. It had for him, Dickens tells us, all the interest of a clever conundrum, the answer to which he had been utterly unable to guess, and, "giving it up," had been told. Here Dickens had come as near as he had till then found it possible to come to the supreme horror—that *the* dead should confront his murderer—not only (as in "Our Mutual Friend") some man supposed to be murdered should confront the associates of the supposed murderer, nor even that a man supposed to be dead should confront a murderer, but that a man supposed to be murdered should keep untiring watch upon the man who supposed himself the murderer. Running through our former essay will be found the idea that this supreme horror was to have been wrought into the plot of Dickens's last novel, and that there is sufficient evidence in the work even in its incomplete state to show this.

We propose now, not to examine the story in detail in regard to the mystery of Edwin Drood's fate, which would occupy much more space than could here be spared, but to touch on certain features of the story which have hitherto been little noticed, if they have been noticed at all, and to consider certain general principles in regard to the interpretation of mysteries such as those involved in this fine unfinished novel.

First, the author's idiosyncrasies must in all such cases be considered very carefully. Some novelists like to disclose the meaning of the events described early in a story, so as to leave the reader in no manner of doubt as to the real position of affairs. Thackeray had few secrets from his readers; and accordingly the story which he left unfinished leaves no more doubt as to the ending than if it had been completed and the reader had turned to the last chapter before he had reached the end of the first volume. Dickens's method was different. He always left his readers—even the keenest—in doubt as to the actual interpretation of mysterious matters introduced early in the story, and as to the precise way in which the story was to end. But he was careful, nevertheless, to introduce a number of little details which were afterwards found to have been significant even on these points, and to have been quite clear for clear-sighted readers on some matters which the duller readers supposed to be mysterious. For instance, while I suppose no one guesses up to the last chapter of "Little Dorrit" the nature of the plot in which Rigaud-Blandois, Flintwinch, and Mrs. Clennam were concerned, or the way in which the story is to end, yet every one of any keenness knows that the old house is to fall before the story ends. Dickens not only made that clear, he *meant* to make it clear. By a curious accident, the fall of a house excited a great deal of attention a few days before the last section of "Little Dorrit" appeared, and several newspaper critics asserted that Dickens had cleverly availed himself of the interest in that catastrophe to add an effective scene to his novel. He pointed out, however, that he had been at the pains again and again to describe the premonitions of the coming fate of the old house. And every attentive reader had known that the house was doomed.

We may fairly assume, then, that in like manner the details of "The Mystery of Edwin Drood" were concealed; and the actual end of the story was not revealed except to Miss Hogarth, and in part to Mr. Forster, while, nevertheless, the broader features of the mystery were not hidden from the keener class of readers, whose enjoyment of the story Dickens well knew would be enhanced by the recognition of the general character of the plot. Dickens did, indeed, express to Miss Hogarth the fear that the Datchery assumption had been so handled in the last chapter (written) as to disclose too much; but he could hardly have intended it to disclose nothing. No one knew better than he the zest with which those who really appreciated his work would enjoy the humour and pathos of this assumption. He would not have left his best readers to obtain this pleasure (the kind of pleasure which is most noteworthy in the reading of all his novels), from a second reading, after the plot was known, as with the duller readers of his stories was commonly the case. The keenest reader would have—or rather we must unfortunately say, the keenest reader *has*—quite enough to interest him in the way of unexplained mystery; but the general interpretation of the "Datchery assumption" cannot be mistaken by any who have really studied Dickens's ways.

Albeit we may pause here for a moment to ask how far any novel, turning chiefly on a great mystery, might have been interpreted if the writer's pen had been disabled ere yet the work was completed. We have already done this with one of Dickens's own works, and we may find another example in "Our Mutual Friend." Does any one from the beginning doubt that Julius Handford, John Rokesmith, and John Harmon are one and the same person? Can any one imagine that Dickens did not mean his readers to note the confusion of Handford under the inspector's questioning, and to see even at that early stage that the body found by Gaffer Hexham is not really John Harmon's. But if that point had been overlooked, a number of others would have been decisive that the whole plot of the story was to turn on the "Rokesmith assumption," and that John Rokesmith was no other than John Harmon. Mrs. Boffin's sudden

* This article, under the title "Aftermath," forms the last chapter of a little book presently to be published by Messrs. W. H. Allen & Co., under the title "Watched by the Dead."

† *Cornhill Magazine* for March 1886.

feeling that the child she had loved had been near her, she knew not how: Rokesmith's start when he heard the name of the adopted child (his own name); his remarks about John Harmon: these all obviously show who he is, and Dickens meant them to be so understood. We have no doubt he meant the identity of Datchery to be similarly recognised by those who knew his method. (Of course, we have very decisive evidence in regard to "Our Mutual Friend" that Dickens did not care to make any mystery of the Rokesmith assumption; for long before the end of the story we find Rokesmith talking about the details of the events which had attended his disappearance from among living men. There is no reason to suppose that he intended to be at all more careful about the identity of Datchery—a little later on though, perhaps, than the story actually reached.)

But it may be well to consider, in passing, two other stories, each turning in marked degree on a mystery—viz. "By Proxy" and "The Moonstone." The former novel admirably illustrates our subject. For although the plot is about as unlike that of "Edwin Drood" as any plot could well be, we have in "By Proxy" a man supposed to be dead, watching the man who is guilty of worse than murder—seeing that he has withheld the price at which he had, as he believes, bought his own life at the cost of a better one. Now in "By Proxy" it is essential to the interest of the latter part of the story that the reader shall not be able to conceive *how* Conway can have been saved, while yet he shall feel that Conway *must* be alive. Accordingly we have not the slightest direct suggestion of Conway's escape from death, except in the rush of a hasty messenger past the flying wretch Conway had saved. Yet we *know* that somehow Conway's escape has been achieved: and at a stage of the story corresponding to that which "The Mystery of Edwin Drood" had reached when the pen fell from the author's hand we have decisive evidence that Conway lives; nor does any one fail to understand the assumption by which he is enabled to meet his daughter without announcing his escape to the man for whom he has designed a fearful punishment.

The mystery in "The Moonstone" is altogether different in character, yet equally serves to illustrate our argument; because in "The Moonstone," as in "By Proxy," "Edwin Drood," and "Our Mutual Friend," the chief interest of the plot (we do not say of the novel as a whole, be it understood) turns on the solution of the mystery. It is noteworthy that, while in the other stories the reader is left in little doubt as to the general solution of the mystery, though altogether doubtful as to details, in "Edwin Drood" and "The Moonstone" even the general meaning of the events described in the earlier pages is left in doubt, at least for all except the very keenest readers. There are touches in the chapters of "Edwin Drood" preceding Edwin's disappearance which show any one who understands Dickens's manner, and has an ear for the music of his words, that Edwin Drood is not actually to be killed, and that the Drood who really is to be seen no more is the light-hearted whimsical boy of the earlier pages. But that evidence was not for all readers. It may even be doubted whether Dickens himself knew how clearly he had disclosed Edwin's real fate for those who knew his voice, any more than many of us know how full of meaning are certain tones of our voice for those who know us well. Nor can one analyse the effect of such tones in a written story any more than in the speaking voice. In reading "Edwin Drood," we (who write these lines) never felt any doubt from the first page to the last that Drood was to be one of the living characters at the close of the story. Yet we could not have given any definite reason for the faith that was in us, until at least the scene where Grewgims tells Jasper that Edwin and Rose had cancelled their plighted troth. In "The Moonstone" no one, we should imagine, has any idea as to the real solution, numerous though the facts are which that solution, and that alone, is to explain. There arises a vague suspicion, as we read about Frank's smoking, his sleeplessness, the difference with the doctor, and afterwards that Frank had slept well on the night of the robbery, that these little details are significant. *Possibly*, if the story had been left unfinished, the same kind of analysis which we have ourselves given to "The Mystery of Edwin Drood" might have led to these points being so carefully considered and put together as to disclose the general nature of the interpretation of the Moonstone mystery—so much, for instance, as *this*, that Frank had himself removed the diamond when under the influence of opium, that somehow Ablewhite had got hold of it, and that in some way unknown Miss Verinder was certain Frank had taken it from her cabinet. This would have explained the position of affairs at the close of the first part of the story, and one can imagine no other explanation consistent with our certainty that Frank has not wittingly had any part in abstracting the diamond, that Miss Verinder is quite incapable of the trick attributed to her by the detective (really keen though he is shown to be), and that Ablewhite has in some way got the diamond into his hands. The details of the disappearance, however, and of course the singularly effective clearing up of the mystery in this fine story (in our opinion far the strongest of all Mr. Collins's novels), could never have been guessed, no matter how close an examination any reader might have given to the earlier part of the story. Yet even these details are suggested when as yet the end of the story is far off.

(*To be continued.*)

COAL.

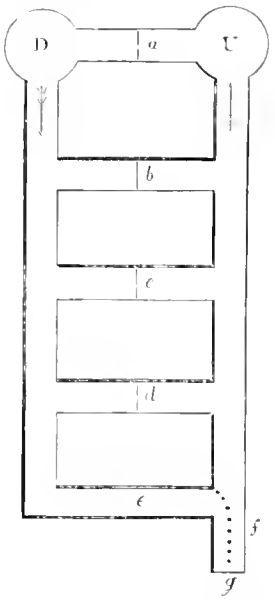
By W. Mattieu Williams.

IN my paper preceding this I described the general nature and magnitude of the problem of colliery ventilation. I will now endeavour to render intelligible the methods of ventilation that are actually adopted, omitting, for reasons already stated, any account of air-pumps, blowing machines, fans, and other devices for mechanical ventilation, and confining myself to the principle explained in my last, which in this country is almost universally applied. This principle is simply the setting of air in motion by its own gravitation by connecting two columns of air of different weights in such wise that the heavier shall descend and the lighter rise in nearly the same manner as do unequally weighted scale-pans.

As it is easier to diminish the density of a given column of air than to increase it, especially where fuel is abundant and cheap, the work of differentiation is carried out by operating on the upcast rather than the downcast shaft. We have simply to raise the mean temperature of one shaft above that of the other, and the required movement is started. The air falls in the cooler and rises in the hotter, forcing its way from the cooler to the hotter through such intervening passages as may connect them. These two shafts may be only a few yards distant from each other, and yet the current of air may be so tortured that it shall travel some miles in passing between.

The diagram shows how this is done. D represents, in horizontal section, the downcast shaft, U the upcast shaft, *a*, *b*, *c*, and *d* are passages or cross roads with doors. It is

evident that if the door at *a* is opened, the air will pass directly by the course D*a*U, as it will take the shortest course open to it. If *a* is closed and *b* open, its course will be D*b*U; if *a* and *b* are closed, and *c* is open, the course will be D*c*U; if *a*, *b*, and *c* are closed, and *d* open, the



course will be D*d*U; if all the doors are closed, the air must (neglecting the dotted line at present) take the long journey D*e*U.

In practice, of course, the arrangements are much more complex, but the principle is the same. It is easy to understand that by skilful arrangements of this kind the air may be made to take any longer or shorter course that may be desired, according to the plan of the pit roads and workings.

But supposing a thoroughfare is required, as continually happens, through a passage that must be closed to divert the ventilation—that coal has to be run through the passage *a* while the air current must pass through *e*, what must be done? This problem is solved very simply. Instead of a single door as marked in the diagram, two doors or "stoppings" are used at sufficient distance apart to allow a tub or train of tubs to stand clear between them with space to spare. The coal enters one door, this door is then shut, and it proceeds to the other.

So far I have only taken the case of continuous passages or roads, but it commonly happens that a working while in progress has no outlet at the working end—is a *cul de sac*. If the extreme distance of this from the road is but moderate and the coal is not exceptionally fiery, the current of air crossing the mouth of the working produces a stir, which, together with the natural diffusive action of gases, supplies sufficient ventilation; but when there is danger of accumulation of fire-damp in the working, a brattice is used, as shown by the dotted line at *f* in the diagram. This brattice, which is simply a partition of wood or of "brattice cloth," effects a further diversion of the current, compelling it to sweep round to the limit of the working at *g* and clear out the dangerous gases that would otherwise accumulate there until, with a limited supply of air, they formed an explosive mixture. These brattice-walls are made by simply erecting upright posts from floor to roof, and nailing the brattice-boards and cloth to them, and carefully fitting to roof and floor.

Much care, of course, is required in the working of the doors in a large pit where they are numerous and complex. A small amount of leakage from each would, of course, retard or stop the current at the extreme limits of its course.

The friction of a long journey effects considerable retardation and practically limits the distance through which the air may be forced to travel. Besides this there is another limitation. As the ventilating current proceeds it picks up the inflammable gas and the carbonic acid expired by the miners. It may even render dangerous those parts of the mine that would be otherwise safe by carrying gas from dangerous localities. Therefore in extensive collieries a system of *splits* is adopted.

This will be understood by again referring to the diagram, where, instead of all the air making the long journey D*e*U, it may be split into four independent currents, one travelling by the course D*b*U, the second by D*c*U, the third by D*d*U, and the fourth by D*e*U. But how can this be done? It is simply a matter of balancing resistances. Other conditions being equal, the resistance varies with the length of the journey; therefore, if resistances be respectively placed at *b*, *c*, and *d*, which shall be just equal to the additional resistance due to increased length of journey in getting round by *e*, the current of air will divide itself accordingly. This may be carried out by making a small opening at *b*, a somewhat larger opening at *c*, and still larger at *d*, while *e* remains fully open. In order that *all* the air shall rush through the diminished opening at *b*, it must do so at an increased velocity, and this involves increased resistance, which varies directly with the length of the journey and inversely with the sectional area of the opening. This balancing of resistance requires skilful management and the aid of regulators to vary the size of the openings as required. In some of the great collieries as much as 300,000 cubic feet of air is passed per minute through all the complications of the roads and workings.

As already stated, the power for setting all this air in motion is obtained by heating the air of the upcast shaft. Formerly a stack was built over the pit, and this was heated by a furnace on the surface. In small shafts a fire was suspended in the shaft, but these are now superseded in large workings by an underground furnace connected with the shaft by an upsloping flue which discharges all the heated products of combustion into the upcast shaft, which is thus converted into a great chimney, the contents of which may be heated to 80° or 100° above the air in the downcast shaft; 140° to 160° being temperatures commonly obtained in the upcast shaft.

The furnace used for heating is one with a large hearth and thin fire, frequently fed with small coal; the width of the fire may be 5 to 10 feet, and the fire-bars as much as 6 feet long. Thus a large area of air is heated at once.

A few figures will show the power that may thus be obtained in a deep mine such as that of Ashton Moss, which has a depth of 2,850 feet. Let us suppose the diameter of the shafts to be 12 feet each; their sectional area will be about 113 square feet, and thus each will contain 113 cubic feet of air for every foot of depth. A cubic foot of air at 60° weighs 1·29 oz. avoirdupois; ∴ 113 cubic feet weigh 9·2 lbs., and the total column of air at 60° = 2,850 × 9·2, which, in round numbers, amounts to 26,000 lbs. But in heating air from 60° to 150°, it expands one-sixth of its bulk; therefore the hot air in the upcast shaft, in such a case, will weigh one-sixth less than the cool in the downcast. This difference amounts to 4,333 lbs. Thus the *vis a tergo*, or force driving the air through the roads and workings and up the upcast shaft, will, in this case, exceed a pressure of 4,000 lbs. It would

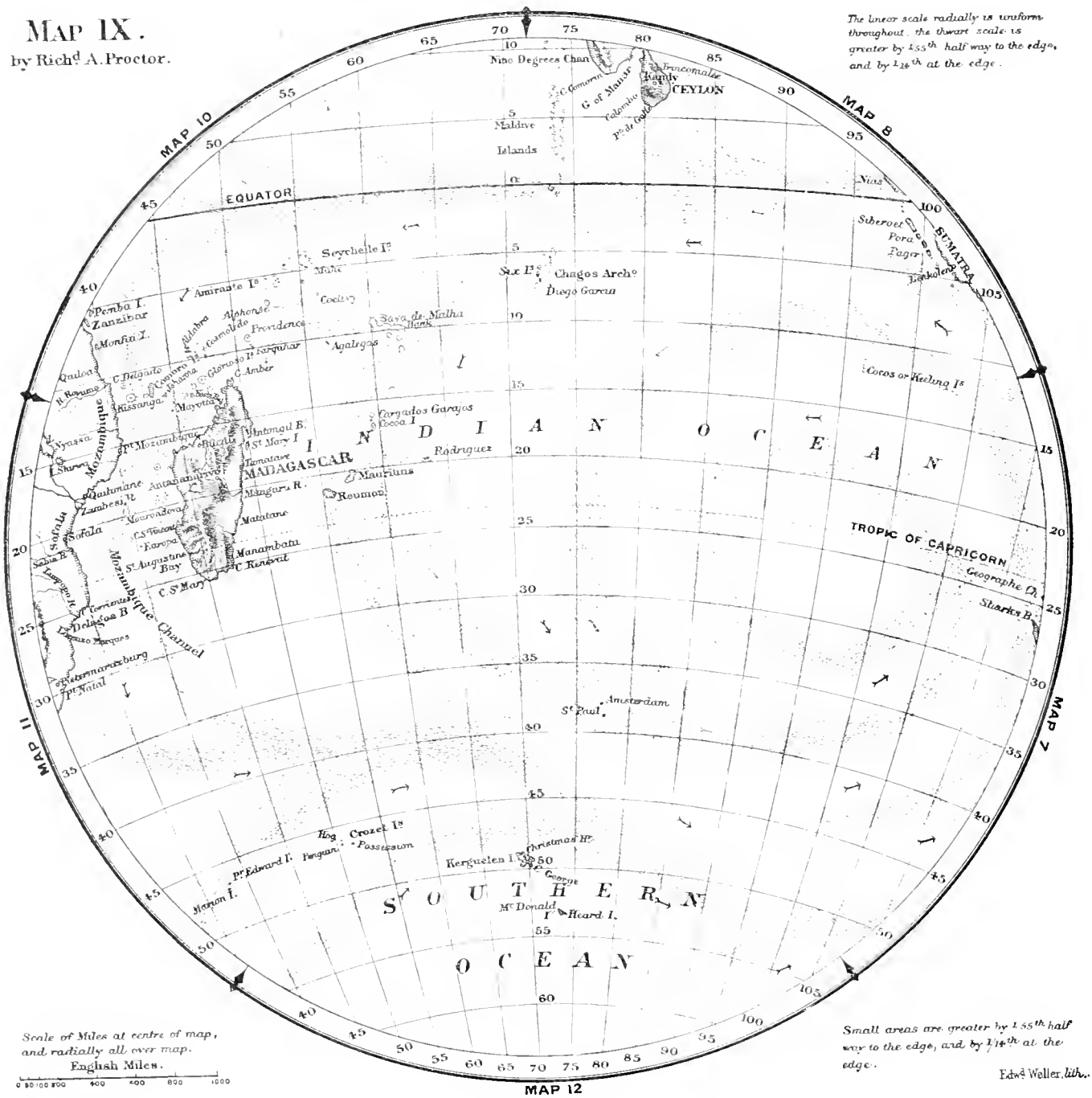
exert that amount of pressure against any unyielding resistance.

From this it will be understood how a gale of wind may be made to blow along the dark subterranean roads of a deep coal-pit. I may add that the figures above rather under-estimate the actual force, as I have taken the air at surface density. It actually increases as we descend—increasing, of course, all the quantities named.

THE ONE-SCALE ATLAS.

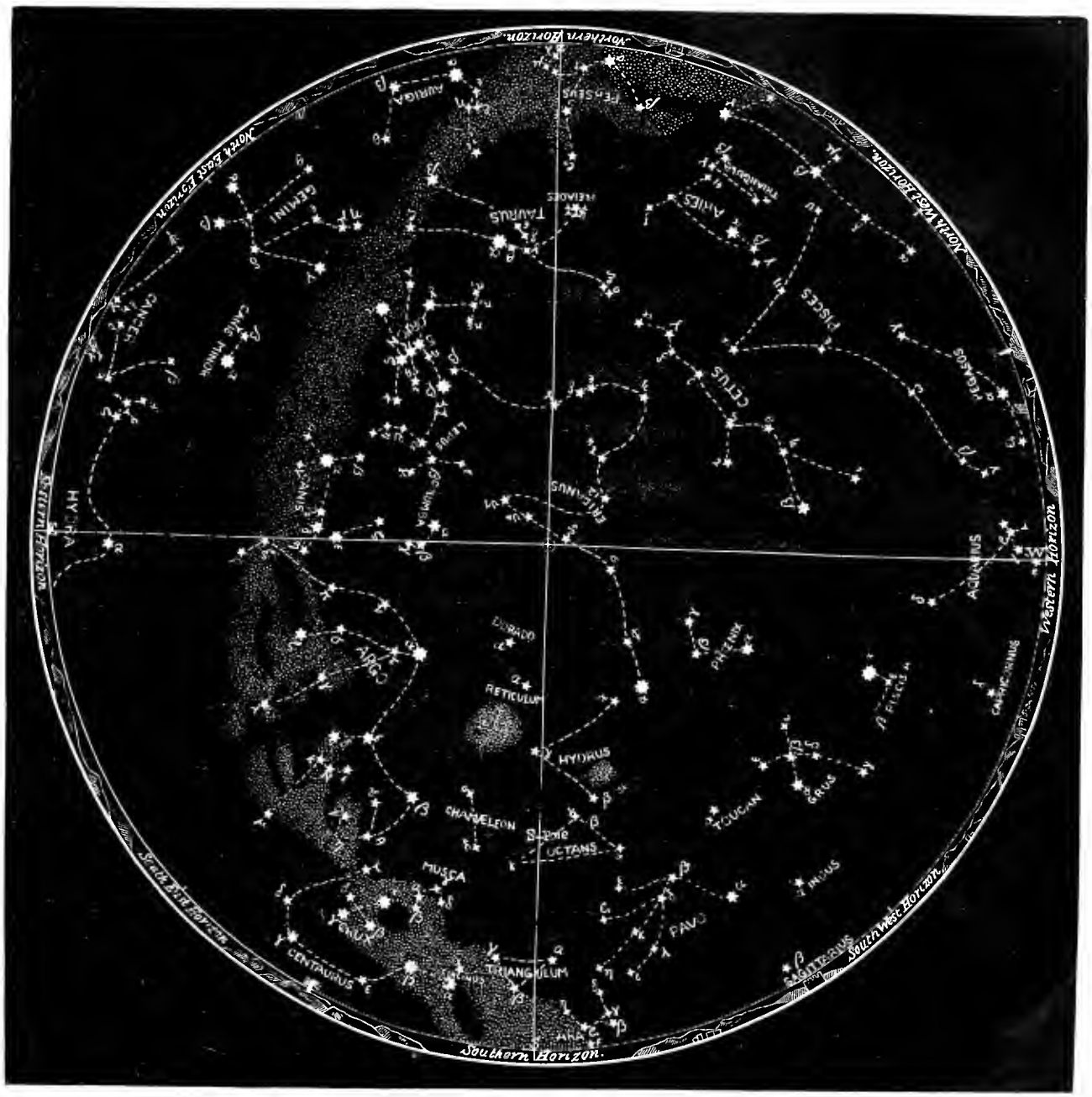
Map IX.

by Richd A. Proctor.



THE SOUTHERN SKIES.

MAP XIII.—For OCTOBER, NOVEMBER, and DECEMBER.



THE NIGHT SKIES IN THE SOUTHERN HEMISPHERE (LAT. 46° TO 21° S.)

AND THE

SOUTHERN SKIES IN ENGLAND (UPPER HALF OF MAP ONLY) AT THE FOLLOWING TIMES:

At 1 o'clock, morning, Nov. 7.	At 11 o'clock, night, Dec. 7.	At 9 o'clock, night, Jan. 7
„ 12.30 „ „ Nov. 14.	„ 10.30 „ „ Dec. 15.	„ 8.30 „ „ Jan. 14.
„ Midnight, Nov. 22.	„ 10 „ „ Dec. 23.	„ 8 „ „ Jan. 22.
„ 11.30 o'clock, night, Nov. 30.	„ 9.30 „ „ Dec. 30.	„ 7.30 „ „ Jan. 30.

STAR MAGNITUDES.

First . . . . ✱ Second . . . . ✱ Third . . . . ★ Fourth . . . + Fifth . . . ▲

SELF-CHARTED STARS.

IN considering such a chart of stars as appeared in the number of KNOWLEDGE for May 1886, considerations of singular, one might almost say quaint, significance are suggested to the mind.

Among all those discs representing stars, and each telling the same wonderful and complex story, no two represent the same time. The story told by that star-chart is not simultaneous. It bears the same relation to a record presenting matters as they actually are at a given moment that a story told by a newspaper bears to a chapter in a volume of history. When we are looking at one star-disc, we contemplate the self-told record of a sun as that sun was many years ago; when we turn to another star-disc, we see a similar record, also relating to a long past epoch, but not to the same epoch. One of the star-discs, regarding it as in a sense a portrait of a remote sun, may be hundreds of years older than another, though both were taken at the same instant on the photographic plate. Probably within the range of this one picture, with its two thousand stars, we have records extending over many hundreds of years. It is true that the picture represents a rich region of the Milky Way, and my own theory of the Milky Way, adopted and supported by such independent thinkers as Herbert Spencer* in England, and Oscar Peschule in Germany, recognises the whole rich galactic mass like that seen in Cygnus as in reality what it appears to be (that is, as truly a stellar cloud, whose farthest portions are not relatively much farther from us than the nearest). Yet it can hardly be but that in the same field of view are seen many stars which do not belong to that cloud, but shine from beyond depths far more remote. Even as regards the great star-cloud itself, moreover, we have a wide range of time to deal with. Judging from the length and width of the great clustering aggregation of the Milky Way in Cygnus, from the heart of which the chart has been taken, we may infer a depth corresponding to more than one-tenth of the distance of the star-cloud regarded as a whole. Supposing this distance, then, to correspond to a light-journey of one hundred years—a very moderate assumption when we remember that Sirius lies at a distance of about twenty years' light-journey from us—we find that the farthest stars of the cluster tell us their story ten years after the nearest stars.

Thus the strange thought arises that while the chart does not represent the actual state of the pictured stars at the moment when the photograph was taken, it does not even represent the state of those stars—either as to relative position or relative lustre—at any epoch whatsoever. For aught we can tell any star taken at random in the chart may have been extinct many years before it painted its record on the photographic plate; or it may at the moment when its light reached us have been in reality very much brighter or very much fainter than its pictured record would seem to show. Stars may in the meantime have shone forth which are not shown in the chart, because the extremities of the light-pencils by which alone their discs could be delineated had not reached within many thousands of millions of miles of our solar system. Then, again, not a single star in the whole chart is shown in its true position, and no two stars are shown in their proper relative position. For every star of the two thousand travelling along through space must have some thwart motion, greater or less (we may exclude as impossible the case of a star moving *exactly* towards the solar system); and no two stars can have exactly the same thwart motion.

Hence have we this strange result, that a photographic record which the astronomer justly regards as a most marvellously exact star-chart, far more exact than any such record as the most skilful astronomers can obtain observationally, nevertheless neither represents what is now, or what ever was—precisely as here shown—at any moment of time.

* As regards important portions of my theory of the universe I was anticipated by Mr. Herbert Spencer—though I only learned this long after I had advanced that theory. But I am speaking above of the Milky Way regarded as a congeries of stars, in which aspect I believe I may say that I alone established those details in which my theory differs from that of the Herschels formerly accepted.

MAGIC SQUARES.*

BY W. HOLDEN.

AS I have not been hitherto "A Constant Reader of your valuable Periodical," I do not know if you have dealt with the subject of "Magic Squares" or not; but I have thought that the enclosed would be interesting to your readers. They appear to me to be marvels of ingenuity. About fifteen years ago the methods of constructing these "Magic Squares," so called, was discussed in "The Riddler" columns of the *Adelaide Observer*, of which columns I have the editing. It appears that the rules for constructing squares, of which the root is an odd number as 7×7, is very simple. Thus I have in my possession a square 27×27, containing all the numbers from 1 to 27^2, and of course the sum of every horizontal, vertical, and diagonal line is $27 \times \frac{27^2 + 1}{2} = 9,855$. But the method of constructing it is so simple that the figures may be written down consecutively without the slightest hesitation. The case, however, is very different when the root is an even number, and especially so when it is the double of a prime number as 14×14. But at the time to which I refer, Mr. E. J. Catlow, who was then engaged as a shepherd in the interior of this "island continent," turned his attention to the subject, and discovered the rules for constructing squares of every kind, no matter how large. He subsequently told me that if he had not turned his attention to the subject, and to the German language, his occupation was so monotonous, and the solitude so profound, that he feared he would have gone insane.

Some time after his discovery of the rules referred to, Mr. Catlow wrote a paper describing them, and sent it to Mr. C. Todd, C.M.G., our Postmaster-General and Government Astronomer. The paper was read by Mr. Todd before the Adelaide Philosophical Society, and he stated that in all his mathematical studies he had never met with any rules of the kind applicable to all numbers.

Curiously enough, however, while Mr. Catlow was studying the subject in the far north, Mr. J. B. Bassett, a schoolmaster of Willunga, thirty miles south of Adelaide, was doing the same thing, and the result was the discussion in the *Adelaide Observer* as to priority of discovery, to which I have referred.

Mr. Catlow and Mr. Bassett have both "joined the great majority," but among the papers of the latter was the square of which No. 1 is a copy. You will observe

* Although in the earlier volumes of KNOWLEDGE we had a great number (some said too large a number) of magic squares, and have in MS. solutions of the still more complex puzzles presented by magic cubes, we print Mr. Holden's paper unhesitatingly, as presenting novel and interesting developments.

that all the numbers from 1 to 32, and from 225 to 256—*i.e.*, the sixteen lowest and the sixteen highest—fill the two top and the two bottom horizontal lines, and that the order

No. 1. COMPOUND MAGIC SQUARE.

Constructed by the late Mr. J. B. Bassett, by rules of his own invention. October 19, 1869.

2	239	242	31	4	237	244	29	6	235	246	27	8	233	248	25
241	32	1	240	243	30	3	238	245	28	5	236	247	26	7	234
34	207	100	184	169	89	72	148	141	150	139	123	102	125	210	63
209	61	104	86	205	212	61	153	122	88	203	214	59	135	33	208
47	194	121	211	62	35	206	136	103	213	60	37	204	154	223	50
224	49	137	45	196	221	52	120	138	43	198	219	54	119	48	193
66	175	152	222	51	46	195	105	151	220	53	44	197	106	178	95
177	96	109	73	88	168	185	157	132	107	118	134	155	116	65	176
79	162	147	170	183	71	90	99	126	149	140	101	124	142	191	82
192	81	70	40	201	216	57	187	165	68	173	180	93	92	80	161
98	143	188	215	58	39	202	69	91	179	94	67	174	166	146	127
145	128	171	41	200	217	56	86	182	77	164	189	84	75	97	144
111	130	85	218	55	42	199	172	76	190	83	78	163	181	159	114
160	113	158	87	74	186	167	110	115	108	117	156	133	131	112	129
15	226	255	18	13	228	253	20	11	230	251	22	9	232	249	24
256	17	16	225	254	19	14	227	252	21	12	229	250	23	10	231

Sum of each vertical, horizontal, and diagonal column of the largest square = 2,056; of the inner = 1,542; and of each of the smallest = 514. Hence the relative value of the sum of each column of the several squares is as 4 . 3 . 1.

of their succession is similar to the knights' leaps over the chess-board. So far the rule is fairly simple, but the arrangement of all the intermediate numbers, so far as I have examined the table, seems quite capricious. Yet it

No. 2 COMPOUND MAGIC SQUARE.

Constructed by Mr. W. F. Campion, by rules of his own invention 1887.

242	238	234	230	1	5	9	13	18	22	26	30	253	249	245	241
3	213	208	204	32	35	39	43	223	48	52	56	219	215	212	254
6	31	190	186	182	57	61	65	70	74	78	197	193	189	226	251
10	36	59	169	164	80	83	87	175	92	96	171	168	198	221	247
14	40	62	79	154	150	97	101	106	110	157	153	178	195	217	243
21	47	66	84	99	141	112	115	143	120	140	158	173	191	210	236
25	51	73	91	102	111	136	125	131	122	146	155	166	184	206	232
29	55	77	95	103	119	124	127	129	134	138	148	162	180	202	228
255	224	199	176	159	144	121	130	128	135	113	98	81	58	33	2
250	220	194	172	152	139	133	132	126	123	118	105	85	63	37	7
246	216	188	167	149	117	145	142	114	137	116	108	90	69	41	11
240	211	185	163	104	107	160	156	151	147	100	103	94	72	46	17
237	207	181	89	93	177	174	170	82	165	161	86	88	76	50	20
233	203	68	71	75	200	196	192	187	183	179	60	64	67	54	24
229	45	49	53	225	222	218	214	34	209	205	201	38	42	44	28
16	19	23	27	256	252	248	244	239	235	231	227	4	8	12	15

Sum of each vertical, horizontal, and diagonal column of the outer square, 2,056. By the successive removal of the margins the sum of each horizontal, vertical, and diagonal column is reduced by 257. Hence the sums are respectively 1,799, 1,542, 1,285, 1,028, 771, and 514.

must have been done upon some recognised system, or it could not have been done at all.

I have failed in my attempts to discover the rules for the construction of No. 2. Mr. Campion is a storekeeper. He was in Adelaide about a month ago, and he informed me that he discovered at the beginning of the present year the rules for constructing all such squares. In proof of this, he has since then sent me a "Jubilee Magic Square," 50 × 50. It covers a sheet of paper about four feet square, and is perfect in every respect. Thus the sum of each column of the outer square is 62,525, with a constant subtrahend of 2,501 on approaching the centre. The subjoined was published in "The Riddler" a few weeks ago:—

Mr. W. F. Campion has furnished us with several more curious magic squares, including the following:—

CHINESE MAGIC SQUARE, 9 × 9.

77	4	3	2	1	72	71	70	69
14	62	19	18	17	58	57	56	68
15	27	51	30	29	48	47	55	67
16	28	36	44	37	42	46	54	66
9	23	33	39	41	43	49	59	73
74	60	50	40	45	38	32	22	8
75	61	35	52	53	31	31	21	7
76	26	63	64	65	24	25	20	6
13	78	79	80	81	10	11	12	5

In this instance the sum of each vertical, horizontal, and diagonal column of the interior square of 3 · 3 is 123; that of the next, namely, 5 × 5, is 205; that of the next, namely, 7 × 7, 287; and that of the outermost 369; thus the sum of every column is a multiple of 41.

NOTE ON EUCLID (I. 32).

(PROP. 3, BK. I.; AXIOM 12, BK. I.; AND PARALLELS).

A CORRESPONDENT asks whether Euclid I. 32 cannot be proved by mechanical considerations independently of axiom 12.

It has always seemed to me that the proposition is self-evident, the mind at once picturing some such angular measurement as is shown in fig. 1. The arrowed rod PQ, pivoting round A to position *pq*, measures the angle A; then, pivoting round B to position *p'q'*, measures the angle B;

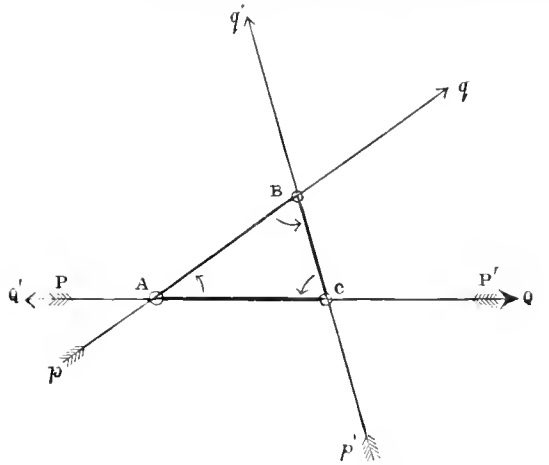


FIG. 1.

and lastly, pivoting round C to position P'Q', measures the angle C. It has manifestly pivoted through two right

angles, lying now in the same direction as at first, with changed ends. Hence the three angles, which are together equal to the angle through which the rod has pivoted in all, amount together to two right angles.

With regard to axiom 12, and the treatment of the whole subject of parallelism and non-parallelism in Euclid, the trouble seems to arise from two causes: First, the use of a negative definition of parallel lines, instead of a positive definition from which the negative property could be deduced; and secondly, from the wish to prove certain matters really axiomatic—for instance, that opposite or vertical angles are equal. The axiomatic ideas underlying axiom 12, which as presented in Euclid (with its converse, Euc. I. 16, as a *proposition* and in company with *propositions* relating to parallels) is not axiomatic at all, may be thus dealt with:—

If the straight lines AB, DE, crossing in C, be supposed shifted so that the point C falls at G in AB, AB remaining unchanged in position, and DE falling into the position FGH, FH can nowhere cut DE. For any argument showing that GF produced towards F would cut CD produced towards D,

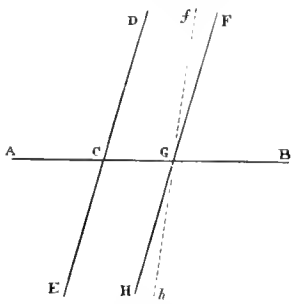


Fig. 2.

would equally show that CE produced towards E would cut GH produced towards H. And if both intersections occurred, the two straight lines DE and FH produced far enough would enclose a space.

This, however, is not axiomatic, unless we take it for granted that the angle FGB, which (we see from the way in which it was obtained) is the same as the angle DCB, is equal to CGH, which (for a like reason) is the same as the angle ACE; for the obviousness of the argument depends on the fact that we have the same arrangement precisely when we look at the figure as it stands that we have when we reverse it.

Now it is not one whit more obvious that two straight lines will not enclose a space than it is that opposite angles are equal, or that two straight lines *can* in any way be so drawn as never to meet.

After it is seen that FGH obtained by moving ACD to position AGF will not cut DCE, it ought to be equally obvious that any straight line *Gf* through G on the side of GF towards D *must* cut CD, no matter how small the angle *f*GF may be. For the point *f* is *some* distance from GF, and by doubling G*f* this distance will be doubled (this may be proved by superposition), and the doubled distance will in turn be doubled in the same way (by quadrupling G*f*), and so on as long as we please: hence we must at length by successive doublings obtain a distance less than the distance of any point in ED from FH; in other words, G*f* produced far enough must pass to the side of EF remote from FH—that is, G*f* will eventually cut ED.

Or we may put the matter in the form of a general axiom,—Through a given point (G), outside a given straight line (DCE), only one parallel can be drawn to that line.

These properties, whether presented as axioms or reasoned out, serve all purposes. But in reality, if such matters are to be reasoned out, then the statement that two straight lines cannot enclose a space should be reasoned out too; and I do not envy any one who makes the attempt. In fact, it leads directly to the discussion of non-Euclidean geometry, a part—and a useless part—of Dream Mathematics.

Of the following three propositions, *which*, dealt with as a subject for reasoning, would be the more difficult?—

First, *Through a given point there cannot be drawn a straight line in the same plane as another straight line, which, being produced sufficiently far both ways, shall meet the latter straight line on both sides of the given point.*

Secondly, *Through a given point there can be drawn a straight line in the same plane as another straight line, which, however far it be produced either way, shall not meet the latter straight line on either side of the given point.*

Thirdly, *Through a given point there can only be drawn one straight line in the same plane as another straight line, which, however far it be produced either way, shall not meet the latter straight line on either side of the given point.*

A FIVE-FOLD COMET.

THE figure illustrating this article is taken from *L'Astronomie*, and represents the remarkable Southern Comet of January last, as drawn on successive days by Mr. Finlay, of Cape Town.

The comet was first seen by a farmer and a fisherman of Blauwberg, near Cape Town, on the night of January 18–19. The same night it was seen at the Cordoba Observatory by M. Thome. On the next night Mr. Todd discovered it independently at the Adelaide Observatory, and watched it till the 27th. On the 22nd Mr. Finlay detected the comet, and was able to watch it till the 29th. At Rio de Janeiro M. Cruls observed it from the 23rd to the 25th; and at Windsor, New South Wales, Mr. Tebbutt observed the comet on the 28th and 30th. Moonlight interfered with further observations.

The comet's appearance was remarkable. Its tail, long and straight, extended over an arc of 30 degrees, but there was no appreciable condensation which could be called the comet's head. The long train of light, described as nearly equal in brightness to the Magellanic clouds, seemed to be simply cut off at that end where in most comets a nucleus and coma are shown.

This comet has helped to throw light on one of the most perplexing of all the puzzles which those most perplexing of all the heavenly bodies, comets, have presented to astronomers.

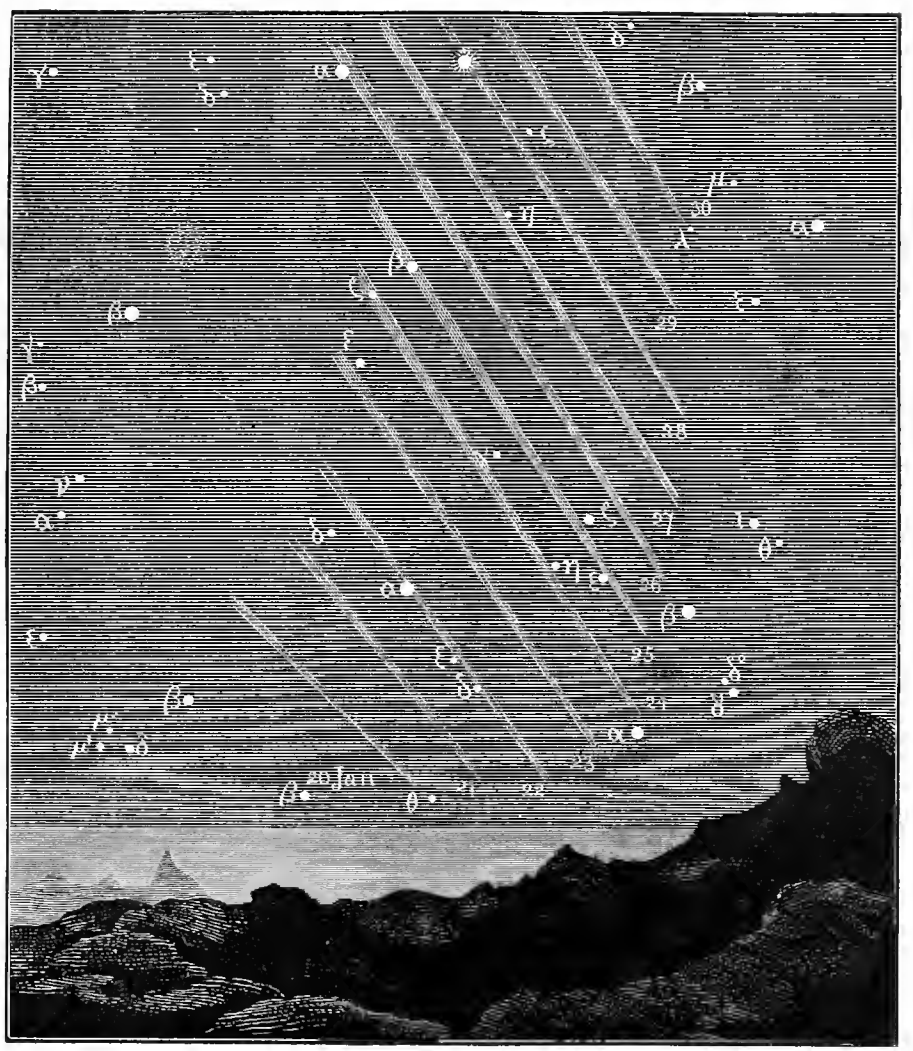
In the year 1668 a comet was seen in the southern skies which attracted very little notice at the time, and would probably have been little thought of since had not attention been directed to it by the appearance and behaviour of certain comets seen during the last half-century. Visible for about three weeks, and discovered after it had already passed the point of its nearest approach to the sun, the comet of 1668 was not observed so satisfactorily that its orbit could be precisely determined. In fact, two entirely different orbits would satisfy the observations fairly, though one only could be regarded as satisfying them well.

This orbit, however, was so remarkable that astronomers were led to prefer the other, less satisfactory though it was in explaining the observed motions of the comet. For the orbit which best explained the comet's movements carried the comet so close to the sun as actually to graze his visible surface.

Moreover there was this remarkable, and, indeed, absolutely unique peculiarity about the orbit thus assigned: the comet (whose period of revolution was to be measured by hundreds of years) actually passed through the whole of that part of its course during which it was north of our earth's orbit-plane in less than two hours and a half! though this part of its course is a half-circuit around the sun, so far as direction (not distance of travel) is concerned. That comet, when at its nearest to the sun, was travelling at the rate of about 330 miles per second. It passed through regions near the sun's surface commonly supposed to be occupied by atmospheric matter.

calculate the return of comets.) The comet of 1680, called Newton's, was the very first whose orbital motions were dealt with on the principles of Newtonian astronomy, and Halley's was the first whose periodic character was recognised.

In 1843 another comet came up from the south, and presently returned thither. It was, indeed, only seen during its return, having, like the comet of 1668, been only discovered a day or two after perihelion passage. Astronomers soon began to notice a curious resemblance between the orbits of the two comets. Remembering the comparative roughness of the observations made in 1668, it may be



The Constellations, though unnamed, can readily be identified, when it is noted that the Comet's course, as here presented, began in the constellation of the Crane.

Now, had the comet been so far checked in its swift rush through those regions as to lose one-thousandth part of its velocity, it would have returned in less than a year. But the way in which the comet retreated showed that nothing of this sort was to be expected. I am not aware, indeed, that any anticipations were ever suggested in regard to the return of the comet of 1668 to our neighbourhood. It was not till the time of Halley's comet, 1682, that modern astronomy began to consider the question of the possibly periodic character of cometic motions with attention. (For my own part, I reject as altogether improbable the statement of Seneca that the ancient Chaldean astronomers could

said that the two comets moved in the same orbit, so far as could be judged from observation. The comet of 1843 came along a path inclined at apparently the same angle to the earth's orbit-plane, crossed that plane ascendingly at appreciably the same point, swept round in about two hours and a half that part of its angular circuit which lay north of the earth's orbit-plane, and crossing that plane descendingly at the same point as the comet of 1668, passed along appreciably the same course towards the southern stellar regions! The close resemblance of two paths, each so strikingly remarkable in itself, could not well be regarded as a mere accidental coincidence.

However, at that time no very special attention was directed to the resemblance between the paths of the comets of 1843 and 1668. It was not regarded as anything very new or striking that a comet should return after making a wide excursion round the sun; and those who noticed that the two comets really had traversed appreciably the same path around the immediate neighbourhood of the sun, simply concluded that the comet of 1668 had come back in 1843, after 175 years, and not necessarily for the first time.

It must be noticed, however, before leaving this part of the record, that the comet of 1843 was suspected of behaving in a rather strange way when near the sun. For the first observation, made rather roughly, indeed, with a sextant, by a man who had no idea of the interest his observation might afterwards have, could not be reconciled by mathematicians (including the well-known mathematician, Benjamin Pierce) with the movement of the comet as subsequently observed. It seemed as though when in the sun's neighbourhood the comet had undergone some disturbance, possibly internal, which had in slight degree affected its subsequent career.

According to some calculations the comet of 1843 seemed to have a period of about thirty-five years, which accorded well with the idea that it was the comet of 1668, returned after five circuits. Nor was it deemed at all surprising that the comet, conspicuous though it is, had not been detected in 1713, 1748, 1783, and 1818, for its path would carry it where it would be very apt to escape notice except in the southern hemisphere, and even there it might quite readily be missed. The appearance of the comet of 1668 corresponded well with that of the comet of 1843. Each was remarkable for its extremely long tail, and for the comparative insignificance of its head. In the northern skies, indeed, the comet of 1843 showed a very straight tail, and it is usually depicted in that way, whereas the comet of 1668 had a tail showing curvature. But pictures of the comet of 1843, as seen in the southern hemisphere, show it with a curved tail, and also the tail appeared forked towards the end during that part of the comet's career.

However, the best observations, and the calculations based on them, seemed to show that the period of the comet of 1843 could not be less than 500 years.

Astronomers were rather startled, therefore, when, in 1880, a comet appeared in the southern skies, which traversed appreciably the same course as the comets of 1668 and 1843. When I was in Australia, in 1880, a few months after the great comet had passed out of view, I met several persons who had seen both the comet of that year and the comet of 1843. They all agreed in saying that the resemblance between the two comets was very close. Like the comet of 1843, that of 1880 had a singularly long tail, and both comets were remarkable for the smallness and dimness of their heads. One observer told me that at times the head of the comet of 1880 could barely be discerned.

Like the comets of 1665 and 1843, the comet of 1880 grazed close past the sun's surface. Like them it was but about two hours and a half north of the earth's orbit-plane. Had it only resembled the other two in these remarkable characteristics, the coincidence would have been remarkable. But of course the real evidence by which the association between the comets was shown was of a more decisive kind. It was not in general character only but in details that the path of the comet of 1880 resembled those on which the other two comets had travelled. Its path had almost exactly the same slant to the earth's orbit-plane as theirs, crossed that plane ascendingly and descendingly at almost exactly the same points, and made its nearest approach to the sun at very nearly the same place. To the astronomer such evidence is decisive. Mr. Hind, the Superintendent of the "Nautical Almanac," and as sound and cautious a student of cometic astronomy as any man living, remarked so soon as the resemblance of these comets' paths had been ascertained, that if it were merely accidental the case was most unusual; nay, it might be described as unique. And, be it noticed, he was referring only to the resemblance between the comets of 1880 and 1843. Had he recalled at the time the comet of 1668, and its closely similar orbit, he would have admitted that the double coincidence could not possibly be merely casual.

But this was by no means the end of the matter. Indeed, thus far, although the circumstances were striking, there was nothing to prevent astronomers from interpreting them as other cases of coincident, or nearly coincident, cometic paths had been interpreted. Hind and others, myself included, inferred that the comets of 1880, 1843, and 1668 were simply one and the same comet, whose return in 1880 probably followed the return in 1843 after a single revolution.

In 1882, however, two years and a half after the appearance of the comet of 1880, another comet came up from the south, which followed in the sun's neighbourhood almost the same course as the comets of 1668, 1843, and 1880. The path it followed was not quite so close to those followed by the other three as these had been to each other, but yet was far too close to indicate possibly a mere casual resemblance; on the contrary, the resemblance in regard to shape, slope, and those peculiarities which render this family of comets unique in the cometary system, was of the closest and most striking kind.

Many will remember the startling ideas which were suggested by Professor Piazzi Smyth respecting the portentous significance of the comet of 1882. He regarded it as confirming the great pyramid's teaching (according to the views of orthodox pyramidalists) respecting the approaching end of the Christian dispensation. It was seen under very remarkable circumstances, blazing close by the sun, within a fortnight or three weeks of the precise date which had been announced as marking that critical epoch in the history of the earth.

Moreover, even viewing the matter from a scientific standpoint, Professor Smyth (who, outside his pyramidal paradoxes, is an astronomer of well-deserved repute) could recognise sufficient reason for regarding the comet as portentous.

Many others, indeed, both in America and in Europe, shared his opinion in this respect. A very slight retardation of the course of the comet of 1880, during its passage close by the surface of the sun, would have sufficed to alter its period of revolution from the thirty-seven years assigned on the supposition of its identity with the comet of 1843, to the two and a half years indicated by its apparent return in 1882, and if this had occurred in 1880, a similar interruption in 1882 would have caused its return in less than two and a half years.

Thus, circling in an ever narrowing (or rather shortening) orbit, it would presently, within a quarter of a century or so perhaps, have become so far entangled among the atmospheric matter around the sun, that it would have been unable to resist absolute absorption. What the consequences to the solar system might have been none ventured to suggest. Newton had expressed his belief that the effects of such absorption would be disastrous, but the physicists of the nineteenth century, better acquainted with the laws associating heat and motion, were not so despondent. Only Professor Smyth seems to have felt assured (not being despondent but confident) that the comet portended, in a very decisive way, the beginning of the end.

However, we were all mistaken. The comet of 1882 retreated on such a course, and with such variation of velocity as to show that its real period must be measured not by months, as had been supposed, nor even by years, but by centuries. Probably it will not return till 600 or 700 years have passed. Had this not been proved, we might have been not a little perplexed by the return of apparently the same comet in this present year. A comet was discovered in the south early in January, whose course, dealt with by Professor Kruger, one of the most zealous of our comet calculators, is found to be partially identical with that of the four remarkable comets we have been considering. Astronomers have not been moved by this new visitant on the well-worn track, as we were by the arrival of the comet of 1882, or as we should have been if either the comet of 1882 had never been seen, or its path had not been shown to be so wide ranging. Whatever the comet of the present year may be it was not the comet of 1882 returned. No one even supposes that it was the comet of 1880, or 1843, or 1668. Nevertheless, rightly apprehended, the appearance of a comet travelling on appreciably the same track as those four other comets is of extreme interest, and indeed practically decisive as to the interpretation we must place on these repeated coincidences.

Observe, we are absolutely certain that the five comets are associated together in some way; but we are as absolutely certain that they are not one and the same comet which had travelled along the same track and returned after a certain number of circuits. We need not trouble ourselves with the question whether two or more of the comets may not have been in reality one and the same body at different returns. It suffices that they all five were not one; since we deduce precisely the same conclusion whether we regard the five as in reality but four or three or two. But it may be mentioned in passing as appearing altogether more probable, when all the evidence is considered, that there were no fewer than five distinct comets, all travelling on what was practically the self-same track when in the neighbourhood of the sun.

There can be but one interpretation of this remarkable fact—a fact really proved, be it noticed (as I and others have maintained since the retreat of the comet of 1882), independently of the evidence supplied by the great southern comet of the present year. These comets must all originally have been one comet, though now they are distinct bodies. For there is no reasonable way (indeed, no possible way) of imagining the separate formation of two or more comets at different times, which should thereafter travel in the same path.

No theory of the origin of comets ever suggested, none even which can be imagined, could account for such a peculiarity. Whereas, on the other hand, we have direct evidence showing how a comet, originally single, may be transformed into two or more comets travelling on the same, or nearly the same, track.

The comet called Biela's, which had circuited as a single comet up to the year 1846 (during a period of unknown duration in the past—probably during millions of years), divided them into two, and has since broken up into so many parts that each cometic fragment is separately undiscernible. The two comets into which Biela's divided, in 1846, were watched long enough to show that had their separate existence continued (visibly) they would have been found, in the fulness of time, travelling at distances very far apart, though on nearly the same orbit. The distance between them, which in 1846 had increased only to about a quarter of a million of miles, had in 1852 increased to five times that space.

Probably a few thousands of years would have sufficed to set these comets so far apart (owing to some slight difference of velocity, initiated at the moment of their separation) that when one would have been at its nearest to the sun the other would have been at its farthest from him. If we could now discern the separate fragments of the comet, we should doubtless recognise a process in progress by which, in the course of many centuries, the separate cometic bodies will be disseminated all round the common orbit. We know, further, that already such a process has been at work on portions removed from the comet many centuries ago, for as our earth passes through the track of this comet she encounters millions of meteoric bodies which are travelling in the comet's orbit, and once formed part of the substance of a comet doubtless much more distinguished in appearance than Biela's.

There can be little doubt that this is the true explanation of the origin of that family of comets, five of whose members returned to the neighbourhood of the sun (possibly their parent) in the years 1668, 1843, 1880, 1882, and 1887.*

But it is not merely as thus explaining what had been a most perplexing problem that I have dealt with the evidence supplied by the practical identity of these five comets' orbits. When once we recognise that this, and this only, can be the explanation of the associated group of five comets, we perceive that very interesting and important light has been thrown on the subject of comets generally. To begin with: what an amazing comet that must have been from which these five, and we know not how many more, were formed by disaggregative processes—probably by the divellent action of repulsive forces exerted by the sun! Those who remember the comets of 1843 and 1882 as they appeared when at their full splendour will be able to imagine how noble an appearance a comet would present which was formed of these combined together in one. But the comet of 1880 was described by all who saw it in the southern hemisphere as most remarkable in appearance, despite the faintness of its head. The great southern comet of the present year was a striking object in the skies, though it showed the same weakness about the head. That of 1668 was probably as remarkable in appearance as even the comet of 1882. A comet formed by combining all these together would certainly surpass in magnificence all the comets ever observed by astronomers.

And then, what enormous periods of time must have been required to distribute the fragments of a single comet so widely that one would be found returning to its perihelion more than two centuries after another! When I spoke of one member of the Biela group being in aphelion when another would be in perihelion, I was speaking of a difference of only three and one-third years in time; and even that would require thousands of years. But the scattered cometic bodies which returned to the sun's neighbourhood in 1668 and 1887 speak probably of millions of years which have passed since first this comet was formed. It would be a matter of curious inquiry to determine what may have been the condition of our sun, what even his volume, at that remote epoch in history.

* It may be interesting to compare the orbital elements of the five comets above dealt with. They may be presented as follows; but it should be noticed that the determinations must be regarded as rough in the case of Comets I. and V., as the observations were insufficient for exact determination of the elements:—

	I.	II.	III.	IV.	V.
Perihelion Passage	1668, Feb. 29	1843, Feb. 27	1880, Jan. 27	1882, Sep. 17	1887, Jan. 11
Log. Per. Dist.	7·6721	7·8335	7·7714	7·8895	8·1644
Long. Per.	80° 15′	73° 30′ 46″	74° 11′ 13″	55° 37′ 29″	89° 41′
Long. Node	357° 17′	355° 46′ 48″	356° 17′ 4″	346° 1′ 27″	359° 41′
Inclination	125° 58′	143° 1′ 31″	143° 7′ 31″	141° 59′ 40″	141° 16′
Eccentricity	0·9999	0·9991	0·9995	0·9999	....
Calculator	Henderson	Plantamour	Meyer	Kreutz	Finlay

SIR HENRY ROSCOE ON ATOMS.

THE general press has done scant justice to Sir Henry Roscoe's Presidential Address to the British Association, the *Times* leading the way in speaking of it as too technical both in subject and treatment. Doubtless it is so for the majority of readers, who need everything pounded into pemmican or condensed into a sort of Liebig's Extract, but not for those who desire to know as far as can be known everything about something rather than something about everything. Sir Henry wisely talked on the subject of which he knows most, and his words were as admirable and clear as his substance was weighty and suggestive.

After justifying the researches of the chemist by their economical results, he pointed out how at the back of all speculations concerning the nature of the motions of which matter is the vehicle, there lies the profoundly interesting question as to the nature and mutual relations of the atoms themselves, the building materials of the universe, and which have known no change amidst the ever-changing combinations into which they enter.

Eighty years ago, Dalton, working in no luxurious laboratory, but with the meagre apparatus of a few cups, penny ink-bottles and self-made thermometers and barometers, discovered that atoms combine in definite proportions of weight and volume with other atoms. He thereby changed chemistry from a qualitative to a quantitative science, giving an impetus to research which at last promises to bring us within sight of the fulfilment of Faraday's prophecy, that "in the end there will be found one element with two polarities." Many workers followed on the lines laid down by Dalton; notably Prout, who formulated the theory that the atomic weights are multiples of the atomic weight of hydrogen, the lightest of the so-called elements, and which he argued might be regarded as the primordial element, the *materia prima*, from which the others are formed by successive condensations.

The researches of the past few years establish the fact that certain of the elements possess such strongly marked likenesses as to warrant their classification into groups, but these groups did not appear to be connected with one another, nor to have any relation to the far larger number of elements not falling into groups. Recently, however, a marked advance towards proof of the common origin of all the elements has been made, in which an English chemist (Newlands) led the van, but in which a Russian chemist (Mendelejeff) has outstripped him in showing that if the seventy "elements" which have thus far been discovered are arranged "in the order of their atomic weights from hydrogen as 1, to uranium, the heaviest, as 240, the series does not exhibit continuous advance, but breaks up into a number of sections, in each of which the several terms present analogies with the corresponding terms of other series. Thus, the whole series does not run a, b, c, d, e, f, g, h, &c., &c., but a, b, c, d; A, B, C, D; α, β, γ, δ, and so on, in recurring similarities." In this we have a *periodic law*, as it is called, which embraces all the elements according to the increasing value of their atomic weights, and which has restored to their rightful place in the succession certain elements for which no place in any of the series of groups could be found. More than this, and as evidencing to the fruitful play of the imagination, Mendelejeff, finding certain gaps between neighbouring elements, pointed out that they could only be filled by elements possessing chemical and physical properties which he accurately specified. And, sure enough, some of these vacancies have been filled by the discovery of elements with the properties which Mendelejeff predicted they must possess. This is as interesting a romance as the discovery of Neptune, the existence of which, it will be remembered, M. le Verrier and Professor Adams independently deduced from the anomalous movements of Uranus, and which "floated into the ken" of Dr. Galle at Berlin when he pointed his telescope to that part of the heavens where the mathematicians told him he would find the planet.

Commenting on this significant grouping of atoms, Professor Huxley, in his masterly survey of the progress of science in Mr. Humphry Ward's "Reign of Queen Victoria," says that it "is a conception with which biologists are very familiar, animal and plant groups constantly appearing as series of parallel modifications of similar yet different primary forms. In the living world, facts of this kind are now understood to mean evolution from a common prototype. It is difficult to imagine that in the not-living world they are devoid of significance. Is it not possible, nay probable, that they may mean the evolution of our 'elements' from a primary form of matter? Fifty years ago such a suggestion would have been scouted as a revival of the dreams of the alchemists. At present it may be said to be the burning question of physico-chemical science." And although no known energy heat that we can apply can separate any one atom into two, so that, as Dalton said, "no man can split an atom," we do not any longer speak of it as indivisible; all that can be said is that it has not yet been divided. That triumph awaits the chemistry of the future, and, when it is accomplished, the witness to the unity of the universe will be complete.

SHAKESPEARE AND BACON.*

By Benvolio.

"Though in thy stores' account I one must be;
For nothing hold me, so it please thee hold
That nothing me, a something sweet to thee:
Make but my name thy love, and love that still,
And then thou lov'st me, for my name is *WILL*."
Shakespeare's "Sonnets."

IN the "Nineteenth Century" for May 1886 an article appeared, in which a particularly preposterous development of the absurd Baconian theory of Shakespeare's plays was brought before the notice of Shakespearean students. We were assured that Mr. Ignatius Donnelly had discovered a cipher which had been craftily concealed within the folio edition of Shakespeare's plays, published after his death, and that in two or three months Mr. Donnelly would publish most surprising readings from the cipher. It does not seem that Shakespearean scholars were very much impressed. The best of them all, the late Dr. Baynes, editor of the "Encyclopædia Britannica," brought out half a year later an appreciative essay on Shakespeare, in which the Baconian theory was not even mentioned. And now Mr. Donnelly feels moved to repeat his assertions and to renew his promises.

In the first place, Mr. Donnelly has persuaded himself that Bacon took special interest in planning cipher systems by which records, such as could not safely be published,

* It is proposed to enter presently in these columns into the study of Shakespeare's nature as unconsciously disclosed in his works, whence also something of his life may perhaps be gleaned. The present essay, from the American "Forum" for October, may be regarded as fitly introducing the series of papers thus planned. Mr. Donnelly's foolish assault on the character and capacity of Shakespeare having in reality (absurd though it was in itself) started the line of thought of which the proposed series of papers will be the outcome.

might be preserved ready for reading, when, later, the key of the cipher was indicated. As a matter of fact, when dealing with "Writing," in the third division of his section on the "Organ of Speech" in his "De Augmentis," Bacon does describe a cipher of his own, which he invented in his youth, at Paris.* But Mr. Donnelly would have done well to notice that Bacon very definitely expresses his opinion about the qualities which a good cipher should possess. If Mr. Donnelly is right about the imagined cipher in the folio edition of Shakespeare, that cipher would be a very bad one, according to Bacon's ideas. "A good cipher," says Bacon, "must absolutely elude the labour of the decipherer," which the folio cipher has failed to do; and "it must yet be commodious enough to be readily written and read," whereas the cipher in the folio, according to Mr. Donnelly's own account of it, would have been fearfully difficult to write, and, as we can judge from the long delay of Mr. Donnelly's promised volume, and the small portion of the folio which he promises to decipher at first, the cipher is singularly difficult to read, even when its key has been discovered.

Passing over the overwhelming antecedent improbability that Bacon ever wrote a line of the Shakespeare plays, and the extreme unlikelihood that he would have devised so cumbrous a cipher (when a few documents left to be read fifty years or so after his death would have served the full purpose attributed to him), let us consider the evidence in detail.

Mr. Donnelly believes that the words of a hidden narrative were to be placed in such situations in the plays, as printed in the folio edition, that when the key was discovered the whole narrative could be put together, Bacon's authorship proved, and many unsuspected details of his life, and of the history of his period, disclosed. It is not easy to present with gravity the first part of the evidence on which this idea, antecedently so absurd, has been based. We are told that Bacon felt sure some student of Shakespeare would notice the frequent appearance of the words "Francis," "Bacon," "Nicholas," "William," "Shakes," "peere," "Shake," "speare," "spurs," "spheres," &c., in the historical plays; he knew further that the ingenious student of the future would immediately associate this observed fact with what Bacon had said about ciphers in his "De Augmentis," and, "having once started upon the scent, would never abandon the chase until he had dug out the cipher." The mixed metaphor is Mr. Donnelly's own.

But now see what curious proof of the existence of special peculiarities Mr. Donnelly has obtained. On page 53 of the "Histories" the word "Bacon" is the 371st from the top of the first column. Now there are seven italic words in that column. Multiply 53 by 7 and we get 371! On page 54, we find in the first column twelve words in italics. Multiply 54 by 12 and we get 648. Counting words from the top of the first column of page 54, we come to the word "Chuffes," in which even the lively fancy of a Donnelly cannot recognise any specially Baconian significance. It is rather hard, because the word "Bacon" occurs in the poetic compound "bacon-fed," thirty-two words earlier, and the word "Bacons," eight words further on.†

But Mr. Donnelly is not to be foiled by such a difficulty as this. Nay, he does not even mention it. Not finding anything to suit him on page 54, from which he had obtained the number 648, he turns back to page 53, without any reason assigned, and finds there the 648th word to be Nicholas—the Christian name of Francis Bacon's father. Even this marvellous result is only obtained by humouring the count. Mr. Donnelly admits that in this case words in brackets are to be omitted; and he must have some system of counting hyphenated words as one or two to bring out the desired result, or else such words as "'twere" for "it were" "a clocke" for "o'clock," and so forth, may be considered single or double as required.

Mr. Donnelly appears not to have been deterred by the failure of the method on page 54 from trying it on page after page, until at last, coming to page 67, he obtained something like a success—at least, to one so sanguine as himself. There are six italic words in the first column of page 67, 6 times 67 is 402, and the 402nd word on page 67 is "S. Albores," for "St. Albans," the place from which Bacon's title was taken. It rather impairs the value of this coincidence that if we are to take "S. Albones" thus as one word, so also should we take "S. Nicholas" as one. Mr. Donnelly has already taken just so much of this word as his case wanted; though, indeed, the iniquity which his theory attributes to Bacon, Shakespeare, Ben Jonson, and all others supposed to be in the plot, is so great, that he might well have taken the whole word—the name of the patron saint of those who commit rascality under cover of darkness—as specially belonging to the imagined cipher system. What he does in one case he should do in the other, only it would not suit his theory to have only "Albones."

I cannot weary the reader with examples of other methods of counting, invented by Mr. Donnelly to serve as occasion may require. It must be admitted that it is not his fault that no constant rule will serve him. Sometimes he must be free to multiply by the number of words in brackets instead of by the number of words in italics; sometimes to count from the top of the page itself, sometimes from the page before, sometimes from the page after; sometimes to count hyphenated words as single, sometimes as double, and so on. But I cannot follow him in detail, because no sensible reader can be expected to examine many of these inanities. Suffice it that among the words found by these multitudinous devices are "volume," "maske," "his," "greatest," "therefore," "shown," "image," "but," "own," and others, which assuredly no one but Mr. Donnelly will regard as amazingly significant.

One case only will I cite as illustrating Mr. Donnelly's singular readiness to be startled into conviction by casual coincidence. The reader should carefully note each detail separately, for there is absolutely nothing to connect them together. The number of page 75 multiplied by 12, the number of italics in the first column of another page, page 74, gives 900; and the number of page 76, multiplied by 11, the number of words in brackets in the first column of the same page 76, gives 836. Now counting from the top of the first column of page 74, omitting words in brackets, and counting the hyphenated words no longer as two words but as one, the 836th word will be found to be the 304th word of

* The cipher is interesting as anticipating the Morse alphabet, in so far as it depends on the varied placing of things of two different kinds—Italic letters and Roman letters in the case Bacon describes.

† I venture to offer Mr. Donnelly a hint, just here. May not these numbers, 32 and 8, be highly significant? Eight is contained four times in thirty-two. Now the word "Bacon" appears only four times in all Shakespeare's plays; and in two of these cases it appears not simply as "Bacon," but in one place as "Bacons" and in the other as part of the compound "bacon-fed." Now, applying a certain rule we imagine we have discovered, we fail to get any Baconian word, but we find two of the "Bacons" out of all the four in Shakespeare on either side of the word we have lit upon—one of them four times as far from it as the other. "Can this be accidental!" Mr. Donnelly should have inquired. Are not the chances thousands to one against the occurrence of so many twos and fours in connection with the word "Bacon"? If any doubt can remain on this point, it ought to vanish when we notice that the numbers 8 and 32 are each multiples of four and powers of two, these powers being also four less one and four plus one respectively. One can go on with such drivel, however, indefinitely.

page 75, and is the amazingly significant word "found"! Beginning from the top of page 75, and counting onward in the same way, the 836th word is "out." But counting from the same points, taking in the words in brackets, and counting each hyphenated word separately, we find the same two words, "found" and "out," each as the 900th instead of the 836th word in its respective count!

On attaining this result, about as interesting as the discovery that the number of words in one of the books of the "Iliad" or "Odyssey" chances to be a perfect square, Mr. Donnelly exclaims: "Can any man believe that this is the result of accident? It could not occur by chance one time in a hundred millions. The man who can believe this is the result of chance would, to use one of Bacon's comparisons, 'believe that one could scatter the letters of the alphabet on the ground, and they would accidentally arrange themselves into Homer's Iliad.'" It must be admitted, however, that the error into which Mr. Donnelly falls as to coincidences of the sort is a common one. "What strange hands were dealt us," someone will say at whist; "I wonder what the chances were that those particular hands would be dealt: millions to one against, I should imagine!" The answer is that the odds were more than six hundred and thirty-five thousand millions to one against those exact hands, but that the question of chance is not affected. Every set of hands at whist might be regarded as a marvellous coincidence if we viewed the matter in that way. The real question is, What is the probability that in a given set of hands odd coincidences may be found, if we look carefully for them? and the answer is, that nearly always you can find such coincidences if you look for them with sufficient patience. And so it is with such counting of pages, italics, brackets, words, hyphens, &c., as Mr. Donnelly has fruitlessly undertaken. You are bound to find hundreds of such coincidences as he notes for marvels.

But we must notice also the strange reasoning by which Mr. Donnelly has persuaded himself that the text of the folio has been altered—"twisted," as he says, "to conform to the requirements of a mathematical cipher"—though Bacon was weak indeed in mathematics. Mr. Donnelly notes the appearance of italicised words, hyphenated words, and words in parentheses, which he insists on calling brackets, and represents as brackets when quoting. He does not seem aware of the fact that when the folio was printed it was the custom to italicise all proper names as they are italicised in the folio, to hyphenate all connected words, such as "lean-on," "get-over," "find-out," &c., and to use parentheses to inclose words presenting an interjected expression or thought, which in modern printing would only be inclosed between commas. (I prefer this old usage myself.)

To show how ready Mr. Donnelly is to imagine peculiarities where in reality all is in order, I note that he regards the lines

> "You are too great to be (by me) gainsaid,"

and

> "I cannot think (my Lord) your son is dead,"

as printed in an unusual and unnatural fashion; and he asserts that in the first part of "Henry IV." such phrases are not so printed. Yet had he but turned for comparison to the most striking of all those passages in the first part of "Henry IV." which relate to the Percy plot, he would have found the lines

> "This bald, unjointed Chat of his (my Lord)
> Made me to answer indirectly (as I said),"

precisely matching the cases which he deems so strange. It would be impossible to convince Mr. Donnelly that lines which he quotes as strange, contorted, confused, &c., are perfectly natural and especially Shakespearean; for he manifestly has not the slightest germ of the faculty which enables the critic to recognise at once the touch of Shakespeare's hand. He finds such expressions as "the dole of blows," walking "o'er perils on an edge" (compare "on the unsteadfast footing of a spear"), and so forth, altogether unnatural. He cannot even understand so simple a passage as—

> "The lives of all your loving complices
> Leane-on your health, the which, if you give o'er
> To stormy passion, must perforce decay;"

asking gravely how lives can decay, when Shakespeare clearly speaks of Northumberland's health decaying. But the greatest absurdity of all, in this connection, is Mr. Donnelly's elaborate mystification in regard to the lines

> "Or what hath this bold enterprise bring forth,
> More than this being which was like to be!"

Of course, "bring" is a misprint for "brought": the folio is far from being so carefully printed that that need astonish us. But Mr. Donnelly says the line "more than this being which was like to be," reads like an extract from Mark Twain's recent essay on "English as She is Taught." Yet, even as Mr. Donnelly misquotes the line, it should perplex no one. "What," asks Morton, "hath this bold enterprise brought forth, more than this condition of affairs which was likely in any case to have come to pass!" It should be noticed, by the way, that in the folio the line runs—

> "More then that Being, which was like to be?"

"Then" is equivalent to "than," and "that" slightly alters the sense; but the point to be noticed chiefly is that the capital "B" marks the word "Being" as a noun (condition, state of affairs), and not the participle for which Mr. Donnelly has manifestly taken it. The comma, also, after Being, makes the sense obvious. The meaning of the passage should be clear, however, without this evidence from the folio itself.

With a lively imagination for the suggestion of impossibly ingenious cipher systems, and complete freedom from such restraints as Shakespearean scholarship would impose, Mr. Donnelly may read almost anything in the folio edition of Shakespeare. He can make his own history of Bacon's secret Shakespearean life, and find every item of it in the plays as printed in that edition. I have little doubt that in this way he has found already, to his own satisfaction, what would be most surprising if really regarded as the work of Bacon. The first sentence he publicly claimed to have read would of itself astound any one who had made any acquaintance with Elizabethan literature. It begins, "I was in the greatest fear that they would say that the image," &c. He might almost as reasonably have made Bacon say, "It was too awfully awful to think that they would say that," &c. Not a sentence published between the years 1550 and 1650, or even until later than 1750, resembles in structure the sentence attributed by Mr. Donnelly to Bacon, a master of the tersest style of which the English language is capable. Mr. Donnelly's marvellous first-fruit was not only a sentence of purely nineteenth-century English, but a very clumsy example even of that.

Finally, Mr. Donnelly pretends to wonder that Englishmen should be wroth with him for striving (as he puts it) to pass the fame due to the author of the plays from one celebrated Englishman to another. The pretence is twofold. No Englishman that I have ever heard of, and no American of English descent (to whom Shakespeare's fame must be as dear as to the native-born Englishman, since birthplace is the merest accident), has ever viewed the Baconian theory of Shakespeare's plays with any feeling resembling wrath. A foolish fancy like that theory may provoke a smile, but certainly no anger; and our amusement can only be intensified by such an amazingly absurd extension of the

theory as Mr. Donnelly has wandered into. But the theory, could it be established, would not hand the fame of "gentle Will Shakespeare" to Bacon, the keen logician and potent reasoner; it would bring discredit to the names of both, as also to others esteemed for varied attainments and qualities, whom the Baconian theory associates with Shakespeare and Bacon in a cowardly and shameful plot.

Gossip.

By Richard A. Proctor.

In this number are begun several of the subjects promised in the announcements made respecting the eleventh volume of KNOWLEDGE. How much more might be done if the public would give one tithe of the support to a magazine relating to science which they will give to a magazine incorporating sensation stories by tenth-rate novelists, few, save the proprietors and publishers of scientific magazines, can guess. Every month's issue of a magazine like this involves a sacrifice of time, labour, and money, entirely inconsistent with the sound old saying that "the labourer is worthy of his hire."

* * *

By an odd coincidence, just after reading through, in KNOWLEDGE for September, an article in which true loyalty and false loyalty were contrasted, I opened the October issue of "The Forum" at the stupendously silly—unless it is to be considered the bitterly sarcastic—article by General Lord Wolseley on "Queen Victoria's Reign."

* * *

General Wolseley found in the Jubilee clatter evidence of love for a family representing "all that we most delight to dwell on in our history," "the heirs of our lion-hearted Richard" (recognised by history as one of the coarsest, and at heart most cowardly of ruffians), "of our Henries of York and Lancaster" (the Henries of York are unknown to history, and only one Henry of Lancaster was even respectable in character and conduct, the fourth Henry being a treacherous murderer, and the sixth a nonentity), and "of our own great Tudor Elizabeth." Queen Victoria's kinship to Elizabeth is remote—to say the least—considering that we have to go back to Henry VII. before we can advance down the line of descent to the one Stuart King of England, through whom the Hanoverian line claims kinship with the earlier monarchs of this country. But when we consider that less than a thousandth part of the Queen's blood came from that Stuart monarch, it is rather absurd to grow enthusiastic about the attributes of the present royal family. Ask Mr. Francis Galton how much of the old fighting and ruling qualities of the Norman kings could have been handed down by direct hereditary descent even to the later Plantagenets, and his answer will hardly favour the idea that, for example, George III., whom Wolseley openly ridicules as a blundering old ass, or George IV., whom sober history recognises as a brainless and heartless humbug, could have inherited any exceptionally kingly attributes from those admirable ancestral plunderers. Loyalty like Wolseley's, which depends solely on the asserted amiability and good sense of the actual monarch, and openly despises her nearer ancestry, is not loyalty at all, even of the poor kind considered—and assuredly cannot be tinselled into better semblance by references to far-back ruffians palmed off in children's histories as gallant knights and able rulers.

* * *

It is not here and thus, however, that General Wolseley chiefly blunders in his easily explained enthusiasm. He deliberately quotes, as the most characteristic samples of true loyalty, conduct which in the selfsame breath he calls superstitious or silly or ignorant (or all three). He was "much struck" by "a newspaper description of the unveiling of the Queen's statue in India," telling how the ignorant natives, regarding it as a kind of idol, "rushed forward and kissed the feet" of it! "The simpler the nature of the people," he justly says (he *must* mean his whole article ironically), "the more unquestioning is their religious faith and that loyalty which is akin to it." Then he tells how a little girl, after the Hyde Park *fête*, went home and told her mother she had seen a balloon go up which had taken "the Queen to heaven." "The idea may" (*sic*) have been "silly in itself, but it signified a train of reasoning in which loyalty was evidently a prominent element." Could anything more sarcastic have possibly been said by the keenest advocate of true *versus* false loyalty?

* * *

Next, the gallant opponent of the superstitious but most loyal followers of the Mahdi tells us how "a poorly-clad nursemaid, pushing a perambulator before her through the crowds in the 'East End,'" expounded *her* ideas about the Queen—and he grows enthusiastic over her utterances: "This simple nursemaid," he says, "like millions of other people, was imbued with the species of hero-worship which in monarchies is known as loyalty."

* * *

Then he somewhat liberates the feline from its encompassment by dwelling on the fact that "personal devotion to the sovereign is more apt to be" (or to seem) lively, "when all favours, rewards, and punishments emanate directly from the throne: the less this is the case, the feebler we should expect to find those feelings of which loyalty is compounded." Possibly General Viscount Wolseley has had occasion to appreciate both that kind of gratitude which has been described as "a lively sense of favours to come," and that anxiety as to punishment which naturally, as he says, suggests the sense of personal—aye, intensely personal—loyalty. If so, he may well ask, consciously and anxiously, whether the spirit which teaches men to despise adulation of the powerful and to advocate true self-respecting loyalty, "confers a boon upon mankind" (as represented by number one) in "seeking to eradicate loyalty" (of the false kind) "from the human heart."

* * *

But if this is the way in which such friends of loyalty, falsely so called, defend it, such loyalty, could it but speak for itself, might exclaim "Save me from my friends,"—with almost as much reason as Gordon at Khartoum.

MYTH, RITUAL, AND RELIGION.*

THE science of comparative mythology is fortunate in having had the methods of its expositors subjected to severe tests at what is still an early stage of its history. We owe no small debt to the scholars who rescued materials which imbed men's thoughts while at low levels of culture from the hands of dictionary-makers and allegorists, and who made plain its deep and long hidden significance. But this must not blind us to the defects of their method, which, as our readers scarcely need to be reminded, explains the repulsive and ludicrous features in the myths of higher races as due to what Professor Max Müller calls a "disease

* "Myth, Ritual, and Religion." By Andrew Lang. Longmans & Co.

of language," to the forgetting of the purer primitive meaning underlying the names of the gods and heroes of mythology, and which it is contended, by an appeal to their supposed etymologies, were, in the first instance, names of the sun, the dawn, the thunder, and so forth.

The arguments in support of this, presented in attractive guise and with much show of reason, in Professor Max Müller's well-known essay, reprinted in the first volume of his "Chips," and elaborated in Sir George Cox's "Mythology of the Aryan Nations," have held the field for some years, being only now and then attacked by skirmishers, or by the light artillery of clever parody. But of late a growing feeling of the insufficiency of a method which rests chiefly on evidence from words as to whose meaning experts differ, and which, moreover, interprets only the myths and rituals of ancient and modern civilisations, while ignoring or undervaluing those of savage races, has arisen, the result of which is to condemn that method as untenable in the main, and as applicable only to a very small portion of the great body of myth.

The impetus to this discrediting of etymology as the sole key to interpretation came from a comparison of the myths of the higher with those of the lower races, which brought out the fundamental likenesses between them in the coarse and wild elements common to each. Anthropologists explain the presence of these elements in Greek, Vedic, and other mythologies, as survivals from the lower culture out of which Greeks and Brahmans have emerged. They are the old Adam which has never been cast out. Like the ancestral history of the type which the embryo repeats in its advance from the egg to the full-grown state, myths preserve traces of the intellectual and spiritual types in which their earliest forms were cast, and thus add their witness to the unity and continuity of history.

Thus viewed, myths, rituals, and religions, wherever found and in whatever refined or unrefined connection, fall into their related place in the general march of man's development. It is of this sound and verified method of anthropology—which has no limitation of race or zone—that Mr. Lang is the most prominent and cultured exponent. He can claim for it, as his letter to Eusebius in the delightful "Letters to Dead Authors" shows, a venerable antiquity, since the learned Bishop of Cæsarea, in treating of the "pagan" mythologies, argued that "they descend from a period when men in their lawless barbarism knew no better than to tell such tales. Ancient folk in the exceeding savagery of their lives made no account of God, but betook them to all manner of abominations. Growing a little more civilised, men sought after something divine, which they found in the heavenly bodies. Later they fell to worshipping living persons, especially medicine men and conjurors, and continued to worship them even after their decease, the Greek temples being really tombs of the dead. (Which, by the way, applies to every Roman Catholic church, since, according to Papal traditions, unconsciously conserving the barbaric worship of ancestors, there can be no altar where there are no relics.) Finally, the civilised ancients, with a conservative reluctance to abandon their old myths, invented for them moral or physical explanations like those of Plutarch and others earlier and later."

Mr. Lang's diligence has also unearthed an essay by Fontenelle, a nephew of Corneille, which was published in 1758, and in which he explains the absurdities of the old mythologies as the legacy of the savage and ignorant ancestors from which every civilised race is descended. He "concludes that all nations made the astounding part of their myths while they were savages, and retained them from custom and religious conservatism." This could not be better or more briefly put.

The space given to a quarterly review article would only suffice to furnish an outline of the profusion of illustration from ancient and modern sources with which Mr. Lang supports his general thesis. The present volumes—as easy to read as a novel, and far more entertaining than nine-tenths of the novels published nowadays—are a careful and elaborate restatement of all that Mr. Lang has hitherto published in fugitive form or in the more collected essays comprised in his earlier book on "Custom and Myth," which was the subject of a lengthy notice in this journal three years ago.

Brushing aside the notion that even in the lowest and crudest myths we touch the beginnings of thought, Mr. Lang gives a rapid but sufficient survey of the interpretation of ancient and modern mythologists, wisely transferring his answer—complete and crushing as it is—to the objections raised against the anthropological methods, chiefly by Professor Max Müller, to an appendix. The body of the book is thus relieved of contentious matter, and filled with examples drawn from the lower and the higher culture, bringing out with clearness the remarkable coincidences between the myths of Greeks and Bushmen, of Finns and Kaffirs, of Aztecs and Zulus. Some prominence is given at the outset to the widespread—we may say universal—attribution of life and personality to everything by savages, and to their belief in descent from sun, animal, or plant, as the key to their theologies, rites, and customs. Very much remains unexplained, but the agreement of the evidence drawn from races between whom no intercourse has taken place since their first dispersion leaves little doubt that such practices as the prohibition against marriage between members of the same tribe-name or totem, and against eating the animal which gives its name to the totem, arise from belief in the near kinship of man and brute.

Mr. Lang's skill in disentangling an intricate subject from the webs of theory-spinners is markedly shown in his two chapters on the gods of the Indian Aryans and on the mythology of Egypt. His sanity of view is apparent in the conclusions at which he arrives concerning the latter, and which agree with the general conclusions reached throughout the volumes. "In Egypt, as elsewhere, a mythical and a religious, a rational and an irrational, stream of thought flowed together, and even to some extent mingled their waters. The rational tendency, declared in prayers and hymns, amplifies the early belief in a protecting and friendly power making for righteousness. The irrational tendency, declared in myth and ritual, retains and elaborates the early confusions of thought between man and beast and God, and between things animate and inanimate. On the one hand, we have almost a recognition of supreme divinity; on the other, savage rites and beliefs shared by Australians and Bushmen. Egyptian religion and myth are thus no isolated things; they are but the common stuff of human thought decorated or distorted under a hundred influences in the course of unknown centuries."

Mr. Lang has an easy task in explaining why certain groups of myth, even those of whole races, as Finns and Scandinavians, should be excluded, at least, for the present, unless his volumes are to grow to unwieldy size. But he gives no reasons for the omissions, here and there, which betray a reluctance to include the myths and legends of Judaism and Christianity as due to the like causes which explain the myths and legends of other religions. Silence upon this subject does harm in fostering prejudices which are strengthened when the mythologies and cosmogonies of a Semitic tribe are treated as an integral part of sacred writings into which there enter elements as coarse and crude as those which are found in Vedic hymns and savage legends. For example, Yahweh (Jehovah) smells the sweet

savour of Noah's sacrifice (Genesis viii. 21), and Indra eats the flesh of bulls ("Rig-Veda x. 28, 3); Yahweh-Elohim creates man out of moist earth (Genesis ii. 6, 7), and the Australian Pund-jeh makes two clay images of men and breathes his breath into them.

We can only conclude this inadequate notice by saying to the solar mythologists that if, after honestly weighing the arguments advanced in this important work, they believe not Mr. Lang and his cloud of witnesses, "neither will they be persuaded though one rose from the dead."

Reviews.

In Cheviots Glens. By JANE T. STODDART. (Oliphant.)—This is a very pleasantly written story of modern life on the Scottish Border. The scenes and characters are not ostensibly sketched from life; but, presuming that they are, none of the originals would, we think, have any good reason to complain that Miss Stoddart had not done them justice. It is a little odd to find the shepherd's son marrying the squire's daughter, even though he was a "meenister"; but we suppose "they do these things better" in Scotland, or oftener, at any rate, than we do here. We have spent a very pleasant hour "In Cheviots Glens," and hope to meet Miss Stoddart in the neighbourhood again.

My Microscope; and Some Objects from my Cabinet. By a QUEKETT CLUB-MAN. (Roper & Drowley, Ludgate Hill. 1s. 6d.)—The Quekett Club, to which this little work is dedicated, is not likely to increase its credit largely by the connection. We are totally unable to see the *raison d'être* of the book. Gosse's "Evenings at the Microscope" has been cheaply reprinted. Houghton's "Microscope and the Wonders it Reveals" is selling at less than a shilling, and there are a dozen other little works which will each tell the beginner twenty times as much as he can learn from the pages before us. It is an elegantly got-up little book, thick paper, large type. The binding is good. The printing is well done. But that is all we can say of praise. The illustrations are few and poor. One roughly depicting a hydra is suggestively labelled on the back "a monster." There is a group of diatoms fairly well drawn in the chapter on "A Skeleton." But the text, instead of giving even their names, indulges in a few generalities on *Aulacodiscus orientalis*, which is not figured. The other chapters treat on "An Eye," "A Wing," "A Slice of Rock," &c., and make a few remarks on a spider, a butterfly, and so forth. The work contains 78 pages. Eighteen are absolutely blank: eleven more, including the dedication and table of contents, share seventy-five words among them. In conclusion we can only regret that any one professing to love the microscope can say so little for it at the price.

A Junior Course of Practical Zoology. By A. MILNER MARSHALL, M.D., D.Sc., M.A., F.R.S., assisted by C. HERBERT HURST. (London: Smith, Elder, & Co. 1887.) As an introductory text-book for the student of zoology, the work of Dr. Marshall and Mr. Hurst leaves little or nothing to be desired. Written with scrupulous care by men personally thoroughly familiar with the objects and processes they describe, and illustrated by woodcuts which, if few, are excellent, the student who will sedulously work through the graduated series of dissections so carefully and minutely treated of in it, will have attained a very considerable knowledge indeed of animal morphology. Our authors begin with the most rudimentary forms of life, the amœba, paramecium, vorticella, &c. (the so-called "infusoria"); and then ascend through the hydra, the liver-fluke of the sheep, the leech, earthworms, and the like; the crayfish, cockroach, lancelet, and dogfish, to the rabbit, fowl, and pigeon. An immense amount of honest work is embodied in the volume before us, which will doubtless speedily attain high rank as a handbook in schools of anatomy and physiology.

Lessons in Elementary Mechanics. By W. H. GRIEVE, P.S.A., late R.N. (London: Longmans, Green, & Co. 1887.)—In simple language, and with an abundant supply of illustrative woodcuts, Mr. Grieve treats of the six "mechanical powers" of the old books on Natural Philosophy: the lever, the wheel and axle, the pulley, the inclined plane, the wedge, and the screw; as also of liquid pressure, the hydrostatic press, liquids under the action of gravity, and the parallelograms of forces and of velocities. The examples selected are derived from objects in familiar use, and the pupil must be abnormally stupid or idle who fails to understand Mr. Grieve's very plain exposition of them. He has done his work well.

Handbook of Practical Botany. By E. STRASBURGER. Edited from the German by W. HILLHOUSE, M.A., F.L.S. (London: Swan Sonnenschein, Lowrey, & Co. 1887.)—We are glad to welcome Professor Strasburger's admirable manual of structural and physiological botany in its English dress, supplying, as it does, a want in our microscopical literature. Nor has our examination of the work seemed to furnish much, if any, justification for the apologetic tone in which Mr. Hillhouse speaks of his translation, since this appears, as far as we can judge, to render the sense, and even in some sort the diction, of the original very well indeed. Famed as Herr Strasburger is as a microscopical manipulator and observer, the exhaustive mass of detailed description of the dissection and preparation of plants for examination which this volume contains cannot fail to be of the greatest interest and use to the vegetable histologist and physiologist. Nothing is omitted which can facilitate the processes described, and profuse illustration supplements directions themselves of the most explicit character. There are careful tables of the plants used for study, the re-agents employed in their examination, preparations for mounting them, &c. In short, this is a book which every microscopist ought to have, and every botanist must have.

An Introduction to Machine Drawing and Design. By DAVID ALLAN LOW. (London: Longmans, Green & Co. 1887.)—This very practical little book is the work of a man thoroughly familiar with the subject of his descriptions, and who further possesses the faculty of imparting his own knowledge easily and pleasantly. It should be studied not only by the young engineer but by the fitter, turner, and, in fact, everybody who has to make drawings of machinery or work from them.

The Problem of Evil. By DANIEL GREENLEAF THOMPSON. (London: Longmans, Green, & Co. 1887.)—Mr. Thompson, in the very able and important work before us, investigates the nature and origin of evil, and essays to point out the most hopeful means for its elimination. In doing this, he perforce discusses what he calls "the Great Theological Superstition," and paints in vivid colours the horrible immorality of the doctrine weekly taught from thousands of pulpits. He discusses at length the suggested methods (social, political, and ecclesiastical) for reducing evil to a minimum, which have been and are still advanced, and shows trenchantly the fallacies which underlie them all. The conclusion at which he arrives is that the elimination of evil, and consequent amelioration of mankind, can only be effected by—first, aiming at the minimum of extrinsic restraint and the maximum of liberty for the individual;

and secondly, aiming at the most complete and universal development of the altruistic character. We will not diminish the pleasure with which the reader will peruse this volume by any more detailed analysis of its contents. Suffice it to say that Mr. Thompson has made a real and enduring contribution to ethical philosophy.

Labour, Leisure, and Luxury. By Alex. Wylie. (London: Longmans, Green, & Co. 1887.)—To any philanthropist who is anxious to celebrate the Jubilee year by doing permanent good to a large and important section of his fellow-countrymen, we would commend the idea of the circulation, broadcast, among the working population of Great Britain of Mr. Wylie's most excellent little volume. As an antidote to the dangerous sophisms and interested rant of Champion, George, Hyndman, and Co., it would be difficult to find anything to surpass it.

Manual of Bacteriology. By Edgar M. Crookshank, M.B., F.R.M.S. Second Edition. (London: H. K. Lewis. 1887.)—Very appreciable justification of the praise which we bestowed upon the first edition of Mr. Crookshank's beautiful work (on page 134 of our ninth volume) is to be found in the fact that after so comparatively short a lapse of time, a second has been called for. Our author has taken advantage of this to add considerably to his work in its original form. The new chapters on Antiseptics and Disinfectants, and on Immunity, possess high interest for others besides the mere specialist. It would be impossible to praise too highly the very beautiful plates with which the volume is so liberally illustrated.

A Photograph, and How to Take It. By "One Who Knows." (London: E. G. Wood. 1887.)—This is a treatise on photographic manipulation for the very beginner, and the instruction it contains is given in such simple language as to be intelligible to the meanest capacity. It is followed by a catalogue of apparatus and materials sold by its publisher.

Tips in Algebra, by Rev. A. D. Capel, M.A. (London: Joseph Hughes. 1887); *Questions in Psychology, Ethics, and Metaphysics*, by F. Ryland, M.A. (London: Swan Sonnenschein, Lowrey, & Co. 1887); *Chemistry for Beginners*, by R. L. Taylor, F.I.C., F.C.S. (London: Sampson Low, Marston, Searle, & Rivington. 1887); *Descriptive Geometry and Graphic Arithmetic*, by W. S. Binns (London: Simpkin, Marshall, & Co.); *Euclid's Elements of Geometry*, Book I., arranged by A. E. Layng, M.A. (London: Blackie & Son).—The somewhat heterogeneous assemblage of books whose titles head this notice possess one attribute in common, and that is that they are one and all written as aids to the miserable examinee in that delightful system now in vogue for obtaining public servants which we have so slavishly copied from the Chinese. They are worthy of being devoted to more useful and laudable ends than that of being employed as mere cram books. To take a single illustration, Mr. Binns's "Graphic Arithmetic" will come almost as a revelation to a very large number indeed of his readers.

Photography.—Messrs. Marion & Co., of Soho Square, London, have just introduced a universal ten-per-cent. solution for developing, which promises to be of great assistance to amateur and professional photographers. The hitherto complicated formulas for developing plates manufactured by different firms may now be dispensed with, as everything is made easy to the operator by the use of this solution. Precise instructions are given on each bottle as to the quantities required for the plates of the principal makers in general use at the present time. The solution has simply to be poured into a bottle, no weights or measures are necessary, and no mistakes can ever occur if the directions fixed on the bottle are complied with.

THE FACE OF THE SKY FOR NOVEMBER.

WE are apparently approaching a period of sunspot minimum pretty rapidly, and days pass without visible signs of disturbance on the sun's disc. At the beginning of the month the zodiacal light still lingers to the south of east before sunrise. Map xi. of "The Stars in their Seasons" shows the face of the night sky. Minima of Algol ("The Stars in their Seasons," map xii.) will occur at 1h. 59m. P.M. on November 1st; at 9h. 52m. P.M. on the 18th; at 6h. 41m. P.M. on the 21st; and at other times more inconvenient to the amateur observer. Mercury comes into inferior conjunction with the sun on the 17th, and is an evening star after that date, but is very badly placed for the observer. Venus is a morning star, and is a brilliant object to the south of east about 3h. A.M. She still exhibits a beautiful crescent in the telescope. She is in Virgo ("The Stars in their Seasons," map v.). Mars is, for our present purpose, invisible; and Jupiter absolutely so. Saturn rises about 10 o'clock at night at the beginning of the month, and soon after 8h. P.M. at the end of it. His ring system will be seen to be very slowly closing up. He will be found a little to the west and north of δ Cancri ("The Stars in their Seasons," map iii.). Uranus cannot be seen until 1888; but Neptune is to be found in the blank part of the sky S.S.E. of the Pleiades ("The Seasons Pictured," map xii.). The moon enters her last quarter at 5h. 2m. in the afternoon of the 8th; is new at 8h. 8·4m. A.M. on the 15th; enters her first quarter at 10h. 13m. in the morning of the 22nd; and is full at 3h. 20·1m. P.M. on the 30th. She will occult seven stars at convenient hours during the month, besides others during the early morning ones. On the 6th, *g* Geminorum, a star of the 5½th magnitude, will disappear at the moon's bright limb at 10h. 34m. P.M. at an angle from her vertex of 338°. It will reappear at her dark limb at 10h. 51m. P.M., at an angle of 302° from her vertex. Before she rises on the 8th she will have occulted 7 Leonis, a 6½th magnitude star. Later it will reappear at her dark limb, at 11h. 8m. P.M., at an angle from her vertex of 182°. On the 18th, 33 Sagittarii, a star of the 5th magnitude, will disappear at the dark limb at 4h. 23m. P.M., at an angle of 38° from the vertex of the moon. It will reappear at her bright limb at 4h. 50m. P.M., at a vertical angle of 1°. Later on, at 6h. 2m. P.M., ξ² Sagittarii, of the 4th magnitude, will disappear at the dark limb at an angle of 103° from the moon's vertex, reappearing at her bright limb at 7h. 5m. P.M., at an angle from her vertex of 330°. On the 20th, B.A.C. 7202, of the 6th magnitude, will disappear at the dark limb at 4h. 46m. P.M., at a vertical angle of 124°. It will reappear at the bright limb of the moon at 6h. 2m. P.M. at an angle of 279° from her vertex. Next at 5h. 35m. P.M. B.A.C. 7209, of the 6½th magnitude, will disappear at the dark limb at an angle of 159° from the moon's vertex. It will reappear at her bright limb at 6h. 32m. P.M. at a vertical angle of 259°. And, finally, 19 Capricorni, a star of the 6th magnitude, will disappear at the dark limb of the moon at 8h. 30m. P.M. at an angle of 114° from her vertex, but she will have set prior to its reappearance at her bright limb. When these notes begin the moon is in Aries ("The Seasons Pictured," plate xxiii.), but at 10 o'clock to-night passes into Taurus. She is travelling through Taurus until 8h. P.M. on the 4th, when she reaches the boundary of the northern prolongation of Orion. It takes her just 12 hours to cross this, and at 8h. A.M. on the 5th she emerges in Gemini ("The Seasons Pictured," plate xxiv.). She is in Gemini until 4h. 30m. A.M. on the 7th, when she quits it for Cancer. She has completed her journey across Cancer by 6h. P.M. on the 8th, at which hour she enters Leo. Here she continues until 6h. 30m. A.M. on the 11th, when she passes into Virgo ("The Seasons Pictured," plate xxv.). Her passage through Virgo terminates at 3h. A.M. on the 14th, and she quits that constellation for Libra ("The Seasons Pictured," plate xxvi.). As she traverses Libra she comes, at 8h. P.M. on the 15th, to the western edge of the narrow northern spike of Scorpio, and when, by 4h. 30m. the next morning, she has traversed this, it is to emerge in Ophiuchus. She passes out of Ophiuchus into Sagittarius at 5h. P.M. on the 17th. She leaves Sagittarius and enters Capricornus at midnight on the 19th ("The Seasons Pictured," plate xxi.). She remains in Capricornus until 1h. A.M. on the 22nd, and then quits it for Aquarius, leaving Aquarius, in turn, for Pisces at 8h. A.M. on the 24th ("The Seasons Pictured," plate xxii.). In her journey through this great straggling constellation she enters on the confines of Cetus at 2h. A.M. on the 25th. At 9h. A.M. on the 26th she re-emerges in Pisces, only, however, once more to enter a part of Cetus at 9h. 30m. A.M. on the 27th. When she finally quits this, at 3h. A.M. on the 28th, it is to enter Aries ("The Seasons Pictured," plate xxiii.). At 5h. A.M. on the 29th she, for the second time this month, leaves Aries for Taurus, and has not completed her journey through the last-named constellation when our notes terminate.

Our Whist Column.

By "Five of Clubs."

CLEVERLY BAD PLAY.

I HAVE given some attention for a long time past to the way in which good play at whist prevails over bad play: so that although for an evening, or even for several days, inferior play may secure the greater number of points, in the long run better play tells, and a certain percentage of advance infallibly shows itself ere many hundreds of points on either side have been scored. Nearly always, I have observed, the more scientific play (by which I do not refer to such details as knowing all the settled details of play—the "signal," the "echo," the "penultimate," and so forth, but following true strategic principles) succeeds most notably against those points on which the unscientific player is most apt to pride himself. Among these are:—(1) Playing for ruffs; (2) drawing two trumps for one when the enemy have declared great strength in trumps; (3) always declining to force the enemy; (4) putting off play by which a sure trick will go to the enemy—though nothing can prevent the trick so going, and it may be of essential importance to throw the lead into his hand at the moment; but there are many other clever dodges which are sure ways to failure in the long run, though they may turn out well perhaps five or six times in a score of trials.

But nothing shows the whist player better the value of sound play than to play for a while with a partner who does not understand the true principles of whist strategy, and puts trust in unsound dodges. Especially, while as yet he is unaware of his partner's foibles, does he suffer: for with a partner of known ineptitude he, of course, does not attempt the higher strategy, knowing that his plans will inevitably be knocked on the head.

Here is an example, which I will not put into tabular form, but describe it as it presented itself—unpleasantly—to my attention.

I was the original leader, and, on examining my hand, found that it contained the following pleasing set of cards (the ace of spades having been turned on my right):—

Spades—queen, ten, nine, four, three: *diamonds*—king, queen, knave, ten, eight; *hearts*—ace; and *clubs*—king, nine.

This was a charming hand to play, with a good partner, holding a fair supporting hand. The object to be aimed at, of course, is to bring in the long diamonds: and with five trumps, heart ace, and a guarded king in clubs, this seems very likely to be brought off. [The score was "One all."] Had I been free to look at my partner's hand in this case, I should have made sure of bringing it off with ease, unless he proved to be a very weak player. Let us see what happened:—

Of course I led a spade, the original fourth best trump; a small trump fell on my left: my partner played the knave: and the trump card, the ace, took the trick. My right-hand opponent, Z, led heart five: my ace took the trick: and four and three fell from Y and B, showing that two must be with Z; and, of course, three others, since he had led his fourth best. I now naturally led the spade queen, the three high trumps left in my hand being now in sequence. King took it on my right, my partner played a small trump, and Z renounced. This renounce looked, of course, unfavourable for my plans: in fact, I could tell that Y either held two more or three: if he only held two, however, I was still sure of success in bringing in my diamonds, provided my partner played rightly. Y returned his partner heart six (the lowest left, except Z's two), my partner took the trick with the king, Z played the two, and I discarded club nine.

At this stage the game was won. My partner held another small trump. We had already made two tricks to the enemy's two. If my partner led his trump I should have made two more tricks, extracting both Y's: have led diamond king, which Y would have taken with the singleton ace he held: and on his leading a heart (his only reasonable lead, but it was indifferent what he held, as my partner held club ace) I should have ruffed and made my four remaining diamonds, the last trick going to my partner's club ace. We should thus have made four by tricks.

But my partner deliberately committed the atrocity of forcing me (original trump leader though I was!) by leading a heart, on which Z put a little one, so that I had not even the satisfaction of ruffing the best heart, yet was unable to resist the force, as I could place two more hearts in Y's hand, so that the force could be repeated by him, and then by Z. (The inexperienced whist-player may ask how I knew Y had two hearts left: simply because my partner not leading the best, Z's play showed he knew Y could take the trick, which at once made his return of the lowest at the fourth trick indicate three hearts then in hand, for every good player returns the lowest of three, the highest of two.) I therefore ruffed, and now, play as I might, we could make only two by tricks. I led my diamond king; Y took with the ace, and, forcing me in hearts, remained with two trumps to my one. If I had taken out both his trumps, and then led diamond king, he would have brought in his partner's hearts, and we should have fared worse. If I had taken out but one of his trumps and then played the diamond king, he could have forced out my last trump with a heart, and on ruffing my diamond queen would have led his remaining heart.

My partner's reason for his atrocious play was that he saw a chance of giving me a ruff, and making one of his own trumps in a ruff. For the chance of one trick (my ruff, of course, was not a trick gained) he—the weak hand—ruined (instead of helping) the play of his strong-handed partner.

It is because of such iniquities as these that Deschapelles said good players of their own hand are *detestable* partners.

From some statistics I have been collecting now for two or three years I have been led to the conclusion that, while simply know-nothing partners lose about one trick in ten, clever players of their own hand lose about one trick in seven.

London Fogs.—Mr. Ernest Hart, of the Smoke Abatement Institute, fears that London will always suffer from fogs, because it is placed in a river valley, on a clay soil, and is bordered on the Essex side by low-lying lands very imperfectly drained, and on the north side by the Harrow Weald. The fogs generated—the results of damp exhalations—are greatly aggravated by the parks, most of which require draining. But if the smoke is got rid of, the fogs will be much less dense.

Our Chess Column.

By "Mephisto."

MATCH, BLACKBURNE *v.* GUNSBERG.

The following games are the first four played in this match at Bradford:—

GAME 1.—(Four Knights.)

White. Gunsberg.	Black. Blackburne.	White Gunsberg.	Black. Blackburne.
1. P to K4	P to K4	19. P to KR4	P to KB4 (1h.)
2. Kt to QB3	Kt to KB3		
3. Kt to KB3	Kt to QB3	20. KP · P	P · P
4. P to QR3 (*a*)	P to Q3	21. P to R5	P to KB5 (*i*) !
5. P to R3	B to K2	(55m.)	(1h. 15m.)
6. P to Q4 (*b*)	Castles (*c*)	22. P to R6	R to Ktsq
7. P to Q5	Kt to Ktsq	(1h.)	
8. B to K3	Kt to Ksq (*d*)	23. Kt to R5	R to KB2
9. P to KKt4 (*e*)	K to Rsq	24. B to Q3	B to B4
(17m.)	(24m.)	25. B · B (*j*)	R · B
10. Q to Q2	P to QB4	26. Q to Q3	R(B4) to Bsq
11. Kt to K2 (*f*)	P to QKt4	27. P to Kt6	R · P (*k*)
12. Kt to Kt3	P to QR3	1h. 25m.)	(1h. 44m.)
13. B to K2	P to Kt3	28. R · R	P · R
14. B to R6	R to Ktsq	29. Kt to R4	P · Kt
15. Castles, QR (*g*)	B to B3	30. KttoKt6(ch)	K to Ktsq
16. QR to Ktsq	R to R2	31. P to R7 (ch)	K · P
17. P to Kt5	B to KKt2	32. Kt to K7	Resigns.
18. B × B (ch)	R B (*h*)	(dis ch)	
(42m.)	(56m.)	(1h. 30m.)	(1h. 50m.)

Notes by Messrs. Blackburne and Gunsberg.

(*a*) The usual continuation here is B to Kt5, as played in the late Steinitz *v.* Zukertort match.

(*b*) The game develops itself into a *Philidor*.

(*c*) Mr. Blackburne now thinks P × P preferable.

(*d*) P to B3 would have been better.

(*e*) To prevent P to KB4.

(*f*) It would not have been advisable to castle too early on the Queen's side.

(*g*) Now White is sufficiently developed to castle on the Queen's side.

(*h*) If Kt had taken B, Black would have had two weak spots on KB3 and KR3.

(*i*) If P moved to K5, White gets a strong attack by P to R6, followed by Q to B3, &c.

(*j*) Kt × BP would also have been a strong continuation, leading to a good many pretty variations, *i.e.*, if 25. Kt · BP, B · B, 26. Kt to K6, to be followed by Q × B, &c.

(*k*) If P × P, White answers by P to R7, which would prove fatal to Black.

GAME II.—(SCOTCH GAMBIT.)

WHITE. Blackburne.	BLACK. Gunsberg.	WHITE. Blackburne.	BLACK. Gunsberg.
1. P to K4	P to K4	(1h.)	
2. Kt to KB3	Kt to QB3	21. Q to Bsq	QR to KB2
3. P to Q4	P × P	22. Kt to K2	Q × Q
4. Kt × P	B to B4	23. R × Q	Kt to K3
5. B to K3	Q to KB3	24. QR to Qsq	P to KR4
6. P to QB3	KKt to K2	25. P to KR4	Kt to R3
7. Q to Q2	P to QR3 (*a*)	26. B to K3	Kt to Kt5
8. P to KB4 (*b*)	B × Kt (*c*)	27. R × R	R × R
9. P × B	P to Q4	(1h. 45m.)	(59m.)
(1m.)	(10m.)	28. R to Q3	P to KKt3
10. P to K5	Q to Kt3	29. R to Kt3 (*h*)	P to Kt3
11. B to Q3	B to B4	30. R to B3	P to B4
12. B × B	Kt × B	31. P × P	Kt × B
13. Castles	Castles KR (*d*)	32. R × Kt	P × P
14. Kt to QB3	QR to Qsq	33. R to KKt3	P to Kt4 (*i*)
15. QR to QBsq (*e*)	P to KR3 (*f*)	34. Kt to B3	P to Q5 (*j*)
16. B to B2	P × P	35. Kt to K4	R to B4 (*k*)
17. BP × P (*g*)	R to Q2	36. Kt × KtP	Kt × Kt
18. Kt to K2	Kt to Qsq	37. R × Kt(ch)	R × R
(15m.)	(29m.)	38. P × R	K to B2
19. Kt to B4	Q to R3	39. K to B2	P to R4
20. QR to Qsq	P to B3	40. P to QKt3	Resigns (*l*)
		(2h.)	(1h. 10m.)

(*a*) Castling, instead of the text move, is recommended by the German masters.

(*b*) Is often played, but never previously by Mr. Blackburne.

(*c*) Best.

(*d*) Castling on the Queen's side would have been dangerous, owing to Black's open QB file.

(*e*) To keep Black's QKt on QB3.

(*f*) A good move.

(*g*) QP taking would have been the better move.

(*h*) P to Kt4 is far the better move.

(*i*) Here K to Kt2 ought to have been played by Black; the text move was quite an unnecessary venture.

(*j*) R to Q2 would still have saved the game.

(*k*) Kt to B5 might have given Mr. Gunsberg more chances to draw.

(*l*) The loss of the game, owing to the two passed Pawns, is now inevitable, the Black King being unable to approach either of them.

GAME III. (GIUOCO PIANO.)

WHITE. Gunsberg.	BLACK. Blackburne.	WHITE. Gunsberg.	BLACK. Blackburne.
1. P to K4	P to K4	21. Q to K2 (*h*)	P to QKt3
2. Kt to KB3	Kt to QB3	22. P to KB3 (*i*)	Kt to Kt2
3. B to B4	B to B4	(16m.)	(1h. 21m.)
4. P to Q3	Kt to B3	23. Q to R6 (*j*)	QR to Ktsq
5. B to K3	B to Kt3	24. Q × P	Kt to Q2
6. Kt to B3 (*a*)	P to Q3	25. P to QB4	KKt to B1 (*k*)
7. Q to K2 (*b*)	Castles (*c*)	26. R to R3 (*l*)	KR to Kt sq
8. B to KKt5	B to R4 (*d*)	27. B to B2	Q to Qsq (*m*)
9. Castles KR	B × Kt	(1h.)	(1h. 53m.)
(10m.)	(25m.)	28. P to B4 (*n*)	QR to Rsq (*o*)
10. P × B	P to KR3	29. Q × R	Q × Q
11. B to R4	Q to K2	30. R × Q	R × R
12. QR to K sq (*e*)	B to K3	31. B × Kt	Kt × B
13. P to Q4	B × B	32. P × KP	P × P
14. Q × B	QR to Ksq	33. P to Q6 (*p*)	P × P
15. R to K3	K to R2	34. Kt × P	R × P
16. P to Q5 (*f*)	Kt to QR4	35. R × P (ch)	K to Kt3
17. Q to Q3	R to KKtsq	36. R to B2	R to R8 (ch)
18. Kt to Q4	P to KKt4 (*g*)	(1h. 26m.)	(1h. 58m.)
(25m.)	(59m.)	37. R to Bsq	R × R (*q*)
19. Kt to B5	Q to Bsq	38. K × R	K to B3
	(1h.)	(1h. 30m.)	(2h.)
20. B to Kt3	R to Kt3	Agreed to draw.	

(*a*) Blackburne usually plays QKt to Q2, or P to B3.

(*b*) Q to Q2 deserves consideration.

(*c*) P to KR3 would possibly have avoided some immediate trouble.

(*d*) Necessary. If Black plays, 8 . . . B to K3, 9Kt to Q5, B × Kt, 10B × B.

(*e*) To prepare for P to Q4.

(*f*) B × Kt would have been much better, for if P retakes Kt to R4 and B5, but, if Q takes, P to Q5, winning the BP.

(*g*) Black dare not take, for, if P × Kt, P to K5 (dis. ch.) wins.

(*h*) P to B3 at once would have been better.

(*i*) If P to R4, Black answers P to Kt5.

(*j*) The endeavour to gain RP loses too much time.

(*k*) Threatening to win the Q.

(*l*) Q to R3 would have been much better, as it would have avoided all subsequent complications.

(*m*) Intending Kt to R4 and R to QRsq.

(*n*) The only move, for if B × Kt instead Kt retakes, followed by R to Kt2, and wins the Queen

(*o*) White threatens R to R3, retiring his Q to R3. Nevertheless Black might have played Kt to R4, for, if White plays R to R3, he should play R to Kt3, and it is difficult to see how White's Q could have been saved.

(*p*) All these moves require a great deal of exactitude. Black must play P × P, although White's Kt gets into a strong position in consequence.

(*q*) With the safe purpose of drawing.

GAME IV.—(RUY LOPEZ.)

WHITE. Blackburne.	BLACK. Gunsberg.	WHITE. Blackburne.	BLACK. Gunsberg.
1. P to K4	P to K4	21. P to QKt3	QR to Ksq
2. Kt to KB3	Kt to QB3	22. Kt to Q3	P to QKt3
3. B to Kt5	Kt to B3	(1h.)	
4. Castles	Kt × P (*a*)	23. Kt to Kt2 (*d*)	Kt to Kt4 (*e*)
5. P to Q4 (*b*)	B to K2	24. P to QR4	Kt to B2
6. R to Ksq	Kt to Q3	25. Kt to Q3	B to Kt3 (*f*)
7. B × Kt	QP × P	26. Kt to KB4	Q to Q3
8. Kt × P (*c*)	Castles	27. P to Kt3	Q to Q2 (*g*) (*h*)
9. P to QB3	P to B3	(1h. 26m.)	(1h. 14m.)
(20m.)	(13m.)	28. P to R4 (*i*)	B to B2
10. Kt to Q3	Kt to B2	29. P to KKt4 (*j*)	Q to Q3 (*k*)
11. B to B4	B to Q3	30. Kt to B5 (*l*)	R × R
12. Kt to Q2	B to KB4	31. R × R	R × R
13. B × B	P × B	32. Kt × R (*m*)	Q to Q2
14. KKt to B4	Q to Q2	33. Kt to B4	P to KR4 (*n*)
15. Kt to Bsq	P to Q4	34. Kt to K3 (*o*)	P × P
16. Kt to K3	KR to Ksq	35. P × P	Q to K2 (*p*)
17. P to B3	Kt to Q3	36. Kt to B5	Q to K5 (*q*)
18. Q to Q2	B to K3	(2h.)	(1h. 47m.)
(45m.)	(27m.)	37. Q to K3	Q × Q
19. R to K2	B to B2	38. Kt × Q	Agree to draw
20. QR to Ksq	R to K2	(2h. 1m.)	(1h. 52m.)

(*a*) The Berlin defence.

(*b*) Steinitz, in his game with Zukertort, here innovated R to Ksq, followed by Kt × P and B to Q3.

(*c*) If White plays P × P, Black's answer will be Kt to B4, when the exchange of Q's would not give any advantage to White.

(*d*) All this subtle manœuvring is for the purpose of acquiring advantages in position, and to avoid a draw by exchanges.

(*e*) To compel White's 24th move.

(*f*) Trying to exchange B for Kt.

(*g*) The position now is of such a nature that Black dare not attempt any advance.

(*h*) Both players think P to QB4 too risky.

(*i*) A very promising line of play.

(*j*) P to R5 deserves consideration.

(*k*) This stops White's threatening advance.

(*l*) If White played QKt to Kt2, Black might reply Q to Kt 6.

(*m*) White dare not take Q.

(*n*) This timely move assists in stopping what there might be left of White's attack.

(*o*) If Q to KKt2, White had a little more chance.

(*p*) To get the open file and prevent P to Kt5.

(*q*) It would not have been safe to leave Black's Q unmolested.

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SHAKESPEARE'S INDUSTRY.

THROUGHOUT the length and breadth of the United States, in almost every newspaper and magazine, attention has been directed, with approval or the reverse, to the recently renewed attacks which a Mr. Ignatius Donnelly has made upon the fame and name of Shakespeare. The tone of many of the comments in Mr. Donnelly's imagined discovery of a cypher in the Folio of 1623, the interpretation of which shows Bacon to have been the real author of the Shakespeare plays, recalls the exclamation of certain ardent Scotsmen after the first performance of Home's "Douglas," "Whaur's Wullie Shakespeare noo?" But it is pleasant to notice that all in America whose opinion can be of any weight consider gentle Will to be where he ever was—enshrined in the hearts of men of English blood, not only as the greatest dramatic poet the world has known, but as one whose works reveal him (almost despite himself, true dramatist that he was) as a man of most lovable nature. The only fault one can find with writers of the latter sort is that they should attach any importance to Mr. Donnelly's nonsensical cypher, the published readings from which are as much like the English of Francis Bacon as the eloquence of a stump orator in the Far West is like the language of a Walter Raleigh. "I was in the greatest fear that they would say that I was," &c., &c., is the beginning of the first sentence attributed by Mr. Donnelly to Francis Bacon! He might as reasonably have attributed it to Roger Bacon or to a Saxon chronicler.

But my purpose is not to follow American writers in discussing either favourably or unfavourably the Baconian theory of Shakespeare's plays—a theory born dead; and still less in commenting on the Donnelly development of the theory, a development whose condition is beyond that of the death stage. I wish to touch on what is undoubtedly the great marvel and mystery of Shakespeare's career, a marvel so great that one almost wonders some mythic developments have not by this time come to surround the story of the poet's life; and I propose to consider as serving to diminish the marvel, a piece of evidence in regard to Shakespeare's career, which, though well known, has never, so far as I know, been read as I am about to read it now.

The great difficulty about Shakespeare has always been that a man with opportunities so imperfect, with a training presumably so insufficient, should be found, within a few years of his leaving Stratford, already high in repute among playwrights, when as yet no poem of his had been published. If we can get over this we can readily understand Shakespeare's rapid advance as something more than a playwright; because we should thus have evidence of dramatic potency (so to describe the special faculty which Shakespeare, beyond all other men, possessed) sufficient to account even for that amazing progress which soon set Shakespeare as far in advance of Marlowe as Marlowe was in advance of Lilly. Deal with Shakespeare as we may, he must remain ever a marvel among men; but if we were to accept the opinion of Emerson that Shakespeare was a miracle, we should lose somewhat of our interest in him as a man. It will suffice that we should regard him as towering high above all other dramatic poets, even as Gauris-Ankar towers high above Kinchin-Gunga, Dhawala Giri, and the lofty peaks of the Knot of Tsunling: we need not regard his greatness as miraculous any more than we need imagine that the loftiest peak of the Himálayas was raised to its present height by the efforts of an imprisoned Titan.

After all, the chief difficulty, if we consider the matter aright, has been in the assumed wildness of Shakespeare's youth, and the inference that what he did he achieved with little effort. That "infinite capacity for taking pains," which is characteristic of genius, has been supposed wanting in Shakespeare's case; and men wonder not only or chiefly that he should have attained the poetic power he presently displayed, but that he should display correct if not very profound knowledge in a number of subjects—law, medicine, surgery, physics, horticulture, history, languages, and so forth—about which he could have learned little in his boyhood and youth.

But we have evidence of an especially satisfactory kind, since it comes from an avowed enemy, to show that Shakespeare must have had just those qualities which, with his innate genius, were alone needed for the acquirement of the knowledge he possessed and the judgment he displayed very soon after his career as actor and dramatist had begun. We learn enough to show that so far from being idle and dissolute, as Donnelly and other detractors pretend, he must have been patient and industrious to a remarkable degree.

The evidence I refer to is that which has been often quoted against Shakespeare—the words in which the dying dramatist Greene warns his fellow-actors and playwrights against the rising poet, whose future fame he evidently foresaw and envied:—"There is an upstart crow," he tells certain of his fellow-playwrights—probably Marlowe, Peele, and Nash—"beautified with our feathers, that, with his *tyger's heart wrapt in a player's hide*, supposes he is as well able to bumbast out a blanke verse as the best of you: and, being an absolute *Johannes Factotum*, is in his own conceit the only Shake-scene in a country." How this should have come to be regarded as injurious to Shakespeare's fame, and how the real though unconscious tribute to his merit involved in it should have been overlooked, I find it difficult to understand. But certain it is that while this passage has been eagerly quoted by detractors, the lovers of Shakespeare have regarded it as involving an attack from which he needs to be defended.

Now, it is obvious to begin with that Greene was full of anger and bitterness when he wrote his "Groat's worth of Wit bought with a Million of Repentance." A dissolute life, to use no harsher expression (where, however, a much harsher expression might be used, when we consider his treatment of his wife), had brought him to a wretched death, on a borrowed bed, where still his thoughts turned towards the poetic fame he had sought, insomuch that his last injunction to the shoemaker's wife, on whose bed he lay dying, was that she would crown his corpse with bays! He had earned considerable fame as a dramatist; indeed, despite his bombast and affectation, his plays indicate a brilliant fancy and marked dramatic power. He probably thought himself the equal of Marlowe, though he was far from that, and therefore superior to all others. The rising fame of

Shake-peare would naturally be a sore point with him, especially when his mind, already diseased, was weakened by the approach of death. I suspect there was also special cause of anger against Shakespeare, who at this time (1592) had probably already worked in collaboration with Marlowe over plays of Greene's own; if so, Shakespeare must have been led to point out defects where Greene could see only beauties. Shakespeare's real offence probably was, not that he thought himself able to "bumbast out a blanke verse," but that he had taken out the bombast from blank verse of Greene's. To a man of Greene's nature that would have been an unpardonable offence.

Yet Greene could find nothing worse to say of Shakespeare, after calling him "an upstart crow"—a mere ebullition of temper—than that he was only the general business man, the man of all work of the theatre, and not the dramatist he thought himself. Think how much genuine modesty it implies on Shakespeare's part, that, with the power he must have recognised within himself ere this, he should only have shown so much confidence as to suggest even to Greene's jealous mind that he thought he might equal Greene or Marlowe as a playwright! The idea that Greene meant to suggest unfair plagiarism on Shakespeare's part, by the reference to a line in the "Third Part of Henry VI."—

O, tyger's heart, wrapt in a woman's hide!

(certainly borrowed, bad as it was, from the "True Tragedie of Richard, Duke of York") will not be entertained by those who understand under what conditions actors of sufficient talent worked upon plays which were the property of their theatre. While it is certain that many passages of the "Third Part of Henry VI." were written by Shakespeare, it is probable that he did not write a line of the old work from which this play was recast. Probably a third only of the modern play is his, nearly another third altered by him and Marlowe, and rather more than a third left unchanged. The line quoted, with slight change, by Greene, is one of those belonging to the old play, and is only used as being abusive, not to insinuate that Shakespeare had stolen what was known by every actor in the company to be one of more than a thousand lines with which Shakespeare had nothing to do. More likely than not, Shakespeare had wished the line struck out, and had been overruled by Greene and Marlowe: certainly Shakespeare would not have been pleased with the use of so coarse a word as "hide" for a woman's skin.

But while Greene's abuse implies absolutely no offence on Shakespeare's part, except a confidence in himself which his subsequent career splendidly justified, Greene reveals the true secret (apart from surpassing genius) of Shakespeare's wonderful success. Shakespeare was "an absolute *Johannes Factotum*." Whatever his hand found to do he did it with his might. Greene had trusted in genius—having, indeed, only talent—and had failed. Shakespeare, full of genius, had also that infinite capacity for taking pains without which even the highest genius can avail little. We need no other explanation of Shakespeare's career. Possessing the profoundest poetic and dramatic insight ever given to man, and with it abundant energy and patience, he could not fail to become the Shakespeare known to the world.

If we may thank Greene for his indirect evidence (where we possess so little evidence of any sort) respecting Shakespeare, we may thank him still more for the direct evidence which his attack elicited, within three months, from Chettle, his executor and publisher. "I am as sory," says Chettle, apologising for Greene's attack, "as if the originall fault had been my fault; because myself have seen his demeanor no lesse civill, than he exelent in the qualitie he professes; besides, divers of worship have reported his uprightnes of dealing, which argues his honesty, and his facetious grace in writting, that aprooves his art."

In studying the life and character of Shakespeare as revealed in his writings, it is my purpose to take his plays in the order in which, so far as we can judge, they were produced. And since in the very beginning of his dramatic work he was engaged in adapting and working up old material, and even in that work was not alone—holding, indeed, at first a subordinate position—it is in such unsatisfactory plays as "Titus Andronicus" and all three parts of "Henry VI." that we must first seek for such evidence about his own life and his own character as Shakespeare may unconsciously have introduced into his plays. Those old imperfect plays contain less direct evidence than later works: yet I think I shall be able to show that we can learn from them somewhat respecting Shakespeare's patient industry, a good deal respecting his modesty, and a little respecting that self-reliance which later led him, with just reason, to prefer his own judgment in dramatic points even to that of men whom at first he had regarded as his teachers.

EVOLUTION OF LANGUAGE.

By Ada S. Ballin.

THERE is a very large number of words, such as I described in my last,* which have originated in the voluntary repetition of the natural vocal expressions of sensation and emotion. From these I will select a few more which will readily suggest others to the reader's mind.

The cry forced from us by a sharp pain is *ah* or *ach*, whence our *ache*, Greek and Latin *ak*, in the sense of sharp, *acutus*, our acute, of pain, &c., and possibly *agony*. The Maori *áks áks* is to split. To this, Key traces also the common Greek suffix *ax* (ακ), which, according to Pott, has the meaning of "little." *Ugh* is a natural expression of cold and horror, and from it Wedgwood derives the Scotch verb to *ug* (houge), to feel abhorrence, and our adjectives *ugly* and *ugsome*, also *huge*:—

What his kind frightened mother *ugs*
Is music to the sodger's lugs—Jamieson, *Sc. Duct.*

To take another example, we find the deaf and dumb make the sound *m'm* or *m'n*, which they use with a shake of the head, to mean "unable to speak," a sound produced by breathing through closed lips. We find it again in the expression, "Mum's the word;" in Quiché *memer*, to become *mute*; in our *mumble*; in Tahitian *mamu*, to be silent. The sound of closing the lips is also very naturally used to express food or the taking of food. One of Darwin's babies, when a year old, invented the word *mum*, meaning food, and used it imperatively in the sense of "Give me food!" Taine's little girl, imitating the sound of snapping up a morsel of food, in her fourteenth month, produced the word *hamm*, which she used to communicate the fact that she was hungry or thirsty. This word, being repeated by her parents in a milder form, lost its original forcible pronunciation, and was modified to *am*, a good example of the manner in which imitative words may become conventional. In the Negro-English of Surinam *njam* (*nyam*) is "to eat," *njam-njam* food. In the African Susu dialect *nimnim* is "to taste;" Zulu *nembita* to smack the lips after tasting, hence to be

* Knowledge, vol. x. p. 129.

tasty, and, figuratively, pleasant to the mind. The Chinese child-word for eating is *nam*, English *nim*. The Swedish dictionary recognises *namnam* as a word for tit-bit, and I well remember in the first pantomime I ever saw—"Puss in Boots"—the Puss, which had stolen some honey, making use of the expression :—

Num-num, isn't it nice,
A flavour far superior to mice ?

an expression which, by the by, found its way into my family on that occasion, and has survived with us ever since. A little three-year-old friend of mine calls everything that she considers nice *nummyna*. Such imitative words are readily formed by children, and sometimes survive by being taken up and repeated by the elders of the family; but they generally disappear when the ordinary word applied to the object indicated is taught to the little one.

As regards the second class, that of words derived by imitation of sounds produced by animals other than man, a great deal has been said by all writers on language, so much so indeed that a favourite theory of the origin of language has been nicknamed by Professor Max Müller the "Bow-wow theory." A very few instances will therefore suffice for my present purpose.

In English, animals are rarely named from their sounds, except in the language of the nursery, as *moo*, cow; *baa*, lamb, sheep; *bow-wow*, dog; and similar instances might be cited from other European languages. To show how general this tendency is we may observe that the natives of the north-east coast of Papua call a dog *bow-wow*; in Australian *twonk* is frog; in Coptic *leiō*, ass; in Chinese *maou*, cat. Corresponding with the English *bumble-bee* we find Sanskrit *bambharâti*, a fly; Greek *bombulos*, Australian *bumberoo*, from the buzzing sound produced by the motion of the creature's wings through the air. Corresponding with our *cock*, nursery *cockadoodledoo*, we find in the Spanish nursery language *quiquiriqui*. Yoruba *koklo*, Ibo *okoko*, Zulu *kuku*, Finnish *kukku*, Sanskrit *kukkuka*. M. Taine's little girl used the word *koko* for chicken (in French nursery language this is a general word for bird), *oua-oua* for dog, and *mia* for cat, imitating as nearly as possible the utterances of the creatures themselves. When the cat was introduced into Egypt from Nubia, the Egyptians called it *miau*.

The third class mentioned in my last article, that of words derived from imitation of sounds produced by motions of inanimate things, is obviously a very large one, far exceeding the other two classes in extent. Thus we have the *rush* of air, the *swish* of water against obstacles, the *roar* of waves, the *sigh* of the breeze, the *murmur* of the sea at rest, the *plash* of its wavelets on the pebbles of the beach, and so on. To come to less poetical examples, we have the *crash* of broken glass, the *slap* of flesh against flesh, the *bang* of a door or explosion, the *ping* of a bullet, the *snap* of fingers or a clasp, the *tingling* of an ear which has been boxed (a subjective sound, the imitation of which has given a name to the *tingling* of any part of the body, other than the ear, that has been struck), the *pop* of a *pop*-corn or *pop*-gun—a word which by similarity, based on the idea of quick motion, has been applied to the *popping* of anything into one's pocket or elsewhere; and by similarity, based on the idea of explosive force, to the *popping* of a certain momentous question. Again, we have the *blazing* of a fire, and "Go to blazes!" is a polite intimation that the person addressed may retire to warmer regions. Then we have "the smasher-and-banger" school of musicians. To *kick* is a seemingly imitative word, as also to *grumble*, *growl*, *moan*, *groan*; to *dot*, as with a pencil on paper and *jot* down notes; to *brush*, *wash*, *sweep*, *rub*, *clap* the hands, *loll* out the tongue—a word applied also to *lolling* on a sofa, for example, the idea of limpness giving rise to this transference. From the imitation of the sound of rapid revolution in air we have the word *whirr*, whence German *wirren*, to twist; French *virer*, English *veer*, as a ship or weather-cock: *whirl*, *whorl*, *warp*, *worm*, in the sense of *wriggler*, whence, also, the derivative *worm* of a screw or helix. The sound is heard also in *writhe*, *wreath*, *wrench*, *wrest*, *wrist*, *wring*, *wrap*, *wry*: Latin, *varus* (with crooked legs), *varices*: English, *varicose* veins, *vermis*, *verminari*, to breed worms or writhe in pain—the Latin sound, which we represent by *v*, being more properly a *w*. Our words *vermilion*, *carmine*, and *crimson*, which now express pure ideas of sight, are due to a word which appears in Latin as *vermis*, in Sanskrit as *krimi*, a worm, the colour being anciently obtained from a shell-fish, which, when removed from the shell, resembles a worm in appearance. To take another example, the sound of *scratching* may be represented by *kar* or *char* (Greek χ): in Latin, *car*-ĕre or *carpĕre* lanam is to *card* wool: *carduus* the teasel, German *krämpal*. The participle *castus* from this verb, *car*-ĕre, in the sense of to purify, gives rises to our *chaste*, an abstract word, which at first sight certainly does not appear to have an imitative origin. In Greek, from the same sound come the words *charasso*, *charakter*, *skariphuō*—our *scar*, *scrape*, *scarify*, *scratch*; Norse *scratha*; German *kratzen*; French *gratter*, whence our *grate*, and the Greek *graphō*, to write (really to scratch with a stylus): Latin *scrib*-ere; German *graben*; Dutch *krabelin*; and English *scribble*; with a host of other derivatives, many of which have by phonetic change lost all apparent sign of their origin. Endless examples of this kind might be adduced both from ancient and modern languages, and the process of making words by imitation of natural sounds is still adopted.

New words imitative of sounds are coined every day among ourselves. A curious instance of this struck me some time ago, and I noted it down. Mr. R. J. Shepherd, writing to the *Lancet* (December 12, 1884) the description of an operation for strangulated hernia, said: "The stricture was at the neck and yielded to the edge of the knife with an audible *snick*."* The italics are my own. In "Numa Roumestan" M. Daudet depicts an old French lady who is somewhat original in her speech, and refers for example to "Cent mille francs en bon argent *tin-tin*," thus illustrating the ring of the true metal, and the fact of the money being paid cash down. She also calls a certain musician "Ce joueur de *tutu-panpan*," upon which Daudet remarks, "Ce 'tutu-panpan' rendait si bien le double instrument, fifre et tambour, que Roumestan se mit à rire" (p. 65). The word *tambour* is itself imitative of the sound produced by the striking of parchment or some similar membrane; it is also seen in our tambourine, *drum*. The sound of bleating is also expressed by the Eastern *tom-tom*, Javan *tumbuk*, Coptic *tinnō*, to pound in a mortar, Malay *tempa tempa*, to beat out, hammer, forge; Chinook jargon *tum-tum*, the heart, *tum-wata*, waterfall. The Gallas of East Africa say, "*tum-tum lufa-lufti*," the workman blows the bellows, a phrase which would be similarly rendered by an English child as: "The *tum tum* (or man that hammers) puffs the puffer." To *smite* or *strike* is in Sanskrit *tup*, *tubh*, Greek *tup*, *tuap*, whence *tympanum*, a drum. The Gallas call a box on the ear *tub-djeda* (to say *tub*), while *tuma* with them means to beat, and *tumtu*, as I have said, a workman. Our word to *patter* is evidently imitative, French *pattatra*. In Australian, *badbadlin* equals our *pitpatting*. The old word *patterero*, an old-fashioned

* There is an obsolete English word *snick*, meaning a small cut or notch, the origin of which is suggested by the above. It is not at all likely that Mr. Shepherd had it in his mind, however.

cannon for throwing grape-shot, is apparently imitative in sound, and its form was probably influenced by imitation, but the real derivation was *pedrero*, Spanish *piedra*, Fr. *pierre*, a stone. Our word to murmur is clearly imitative, and with it may be compared the Tamil *muru-muru*.

The origin of such words as *whisper*, *listen*, Ger. *flüstern*, *hush*, was probably imitative. *Silence!* is a command expressed among the Sioux by *hush-sh!* among the Veddahs of Ceylon by *iss!* and in Japan by a hiss, with which may be compared the Gr. *sizô*, to hush, command silence. As Wedgwood suggests, the savage watching for foe or prey would hear, or fancy he heard, a *rustling* among the leaves of the thicket or long grass, and in order to attract the attention of his companion or companions would softly imitate the sound, and thus produce such exclamations as hush! whist! st! &c., which would soon take their place in speech, and give rise to derivatives, becoming at the same time conventionalised in pronunciation.

Dr. Comrie says * that the natives of the north-east coast of Papua, when shown an iron axe, named it *din-din*, from the sound which it produced. When I was a little girl I used to call hammering "dodding," and I always believed that the old carpenter who used to work at the house, whose name was Dodd, was so called because he "dodded."

The spirit of imitation, besides giving birth to language, exercises a great influence upon the word after it has come into being.

When words are reduplicated or lengthened out in order to express degrees of comparison, the representation of thought is practically pictorial. Thus in French *beaucoup* is much, *beaucoup-beaucoup* very much, and the same mode of expression is common to the most widely different races. Among the Dyaks *kwai* is strange, *kwai-kwai* very strange; *ku-lyang* is to think, *ku-lyang-ku-lyang* to think deeply. In Madagascar *ratchi* is bad, *râtchi* very bad. Among the Watchandi of Australia *jir-rie* means already or past, *jir-rie-jir-rie*, a long time ago, and with much lengthening of the first syllable, *jie-r-rie-jirrie* an immense time ago. A Brazilian tribe has the word *ouaton* for stream, which becomes *ouatou-ou-ou-ou* for sea. The Aponegierans for "six" use a word *itawuna*, and for "seven" *itawuūna*=a long six.

A child relation of Wedgwood's used the word "baby" as a diminutival prefix. Baby Thomas was the smaller of two men-servants of that name. To express further diminution, he narrowed the sound to *beebee*, and very small objects became *beebee-beebee* things. This word is probably connected with *wee*, and a baby friend of mine is always called *Wee-Wee*. Reduplication seems naturally to convey the idea of repetition, continuance, or an increased degree of the state indicated, *e.g. tiny*=small, *tiny tiny*= very small.

In Maori *puka* is to pant, *puka-puka* the lungs; *muka* flax; *muka-muka* to wipe, rub, for which flax is employed; *mura* to flame, *muramura* a flame. In Malay *ayun* is to rock, and *ayunayunan* a cradle. In Africa the Wolof dialect has *sopa* to love, *sopsopa* to love constantly, and Mpongwe has *kendu* to walk, and *kendagendu* to walk about for amusement. In Dayak *kaká-kaka* means to continue laughing loudly."

In Chinese, frequentatives or the repetition and continuation of an action are expressed by repeating the primitive syllable, as *mô-mô*=to go on rubbing; *hŏ-hŏ*=to keep on drinking; *t'iaú-t'iaú*=to jump about. The repetition, however, sometimes serves to intensify the meaning of the primitive. It gives the notion of "a good many," "all," "every," to a single, as *jîn*, man, *jîn-jîn*, everybody, all men or most men; *jĭ*, day, *jĭ-jĭ*, daily; *chĕ-chĕ sāng-píng*, each (animal) is sick; *shĭ-shĭ k'ō-liên*, truly to be pitied; *tĭ tsŭ-hiūm-hiūm*, completely intoxicated.

Similarly in colloquial speech, we say, "He went on write, write, write;" "I like it very, very much;" "Oh, go on, talk, talk, talk," and so on.

In the early stages of language there seems to have generally prevailed a love of reduplication for the mere pleasure of repetition, as well as for the sake of greater clearness and pictorial effect. In South America there is a river *Bio-bio*, a rodent *tuco-tuco*, and so on; and the Maori dictionary is full of words of such formation as *mati-mati*, toe; *êmi-êmi*, tree; *âki-âki*, to urge; and *âti-âti*, to drive away. In Hebrew the superlative is formed by repetition of the adjective. In Breton from *mâd* comes *mâd-mâd*, best; from *fall*, bad, *fall-fall*, worst. The French have *bon-bons*, goodies. Reduplication seems, therefore, to intensify an action or quality; and duration of time, as well as largeness and smallness of dimension (intensification), is also expressed by the lengthening out of vowels.

With regard to the long vowel of the present tenses of Latin and Greek verbs, in place of the short vowels of the stems, and the strengthening of the final consonant, it has been suggested that its origin is really imitative, denoting the duration of the act, as when we say, "He came *creeeping* along," or "He *draaawls* out his words." Thus, *phaīno*, *scrībo*, *dīco*. While, on the other hand, the short penult of *etupon*, *elubon*, *elathon*, &c., agrees with the momentary nature of the act.†

In the many words and roots which I have mentioned, and in thousands of others which I might record if space permitted, the imitative or pictorial origin is clear; and as I have shown‡ that the trace of the origin of words is easily and most frequently obliterated by the growth and wear and tear of language, the inference is patent that imitation must have played a most important part, if not *the* most important part in the first development of speech.

* "Journal of the Anthrop. Inst.," vi. 2 (Oct. 1879).

AMERICANISMS.

Gobbler, for a turkey cock, is probably no more an Americanism than *Bow-wow* for a dog. Readers of "The Pioneers" will remember how the owner of the unlucky turkey to be shot at by Leatherstocking and the big Vermonter calls to his bird, "Poss up a gobbler." The expression belongs rather to nigger patois than to American English.

Go. A State is said to *go* Democratic, or to *go* Republican, when it votes for one or the other cause after being for a time doubtful, or on the other side.

Go by, To. To stay; *not* to go by, as we understand the words in England. This peculiar usage belongs to the Southern States. The explanation is not so difficult as might be expected. Where in journeying a traveller has a choice of ways, as in the South is generally the case, a friend will say to him, "Go by my plantation and stay with me," meaning simply choose that way. Later such a request would be shortened into "Go by and stay with me." Southerners do well to get a convenient expression for such cases, seeing that they are of all men in the world the most hospitable and generous.

Go for, To. To go for any one, in the sense of attacking him, appears to be an expression of Southern origin, though now heard commonly enough all over the States.

† T. H. Key, "Language: its Origin and Development," 1874, p. 144.

‡ Knowledge, vol. ix., p. 85 *et seq.*; p 141 *et seq.*

It may possibly have been suggested by those Southern duels in which the combatants were left free to seek for each other over a wide tract of country. For if a Southerner's generosity knows no limit, neither does his combativeness, when he considers it justifiably excited.

GO IT ALONE, To. In euchre a player may decide to play the hand alone, his partner turning down his cards (sometimes after giving the best card to the lone player, who then discards his worst). Success in such a case counts double, as also does failure. A player who thus decides to play alone, is said to "go it alone," and a similar expression is applied to one who decides to carry out any business operation on his own sole responsibility, and without help from others.

GO IT BLIND, To. At poker a player who bets on his hand before seeing it is said to "go it blind," and the usage is extended to any one who in any undertaking trusts blindly to chance.

GOLLY! Used *euphemistically* (says Bartlett!) for "God." Dogberry could hardly have beaten this; God forbid but God should go before such a villainous niggerism as Golly.

GONE CASE, for a person or event past hope is as much English as American: but

GONE COON, for one in hopeless case, is a good Western Americanism, simply because we have no racoons in the home country.

GONE GOOSE, GONE GANDER=Gone Coon: nor is "gone gosling" different in significance, save perhaps that it suggests a more youthful unfortunate.

GONER=gone goose, &c., &c. The "r" termination may be regarded as simply the usual Teutonic way of indicating personality. The Greeks and Latins preferred "s."

GOOD, for "well" is simply an Americanism in being a piece of bad grammar more commonly heard in America than in England. But the word "good" is also used in America in a way which must be regarded as essentially American. Thus, "Take that toddy; it will make you feel good," by no means signifies, as an Englishman might suppose, that imbibing the toddy will produce a virtuous feeling (though I have known men who have mistaken intoxication of one kind or another for saintliness); it means simply that after taking the toddy you will feel, or the toddy-maker hopes you will feel, jolly. This peculiar usage has proved a source of perplexity in some cases, and of amusement in others, to Englishmen passing their time in the States, whether on pleasure or instruction bent. A friend of mine tells how a proposition was once invitingly made to him which, to say the least, involved no virtuous self-abnegation, and he was urged to accept it by the plea that "it would make him feel *good*."

GOODIES. Mr. Bartlett is good enough to inform us that "goodies," for sweetmeats, is "provincial in Suffolk, England." I have yet to learn of any part of England where sweetmeats are not called "goodies."

GOOSE, SOUND ON THE. In the Southern States, in the old slavery times, to be sound on the goose, meant to be orthodox on the slavery question. As to the origin of the expression, this deponent, knowing nothing, says the same.

GOOSE HANGS HIGH, THE. All is serene. The origin of this expression is also lost in mystery.

GOPHER. Any mining or burrowing creature seems entitled to be called a "gopher" in the States. In the middle States the term is usually applied to a species of mole; elsewhere to a kind of squirrel; while in the South a gopher is a species of land-turtle which, in the low country, burrows in the ground.

GOSH. Used in a form of oath, which Mr. Bartlett insists on considering "euphemistic," insomuch that one is led to wonder what he understands by "euphemism." If "by Gosh!" is euphemistic to Mr. Bartlett's ears, what, one would like to know, would he regard as cacophonous?

GOTHAM. A name applied to New York by Washington Irving, and now constantly employed as a synonym for the American metropolis—so that

GOTHAMITES are New Yorkers.

GO THROUGH, To. After explaining that our English expression "to go the whole hog" is "a Western vulgarism caught up by some late English writers"—though Cowper long since gave the saying position—Mr. Bartlett is kind enough to tell us that whereas Americans say this train goes through to such and such a town, meaning—well, meaning—that it does go through, we benighted Britishers would imagine if we heard such an expression that a tunnel was referred to! It might perhaps surprise him to learn (only he is dead) that not only do we speak of a train going through to a place, without thinking of tunnels, but we have gone a step beyond, and devised the term "through train" for a train that does in this way go right on to some specified place.

GO THROUGH, To. In the sense of robbing any one of everything he possesses, the verb "to go through" would appear to be essentially American. The practice, however, is not so limited.

GO-TO-MEETING as an adjective, "Go-to-meeting hat," "go-to-meeting clothes," &c., is as much English as American.

GOUGE, To. To force an eye-ball out with the thumb. This practice, always, let us hope, confined to the most brutal of the lower orders, is now no longer in vogue in any part of the States. How much there is to choose between gouging and shooting, I do not know. As tokens of savagery they seem much on a par.

GRACIOUS! MY GRACIOUS! GRACIOUS SAKES! and GRACIOUS SAKES ALIVE! These exclamations are tolerably familiar in England; but Bartlett, because, like so many others, they have been migrations, deals with them as Americanisms of the purest water.

GRADE, To. To change the level of a road by excavating. I have not heard this word commonly used in this sense in England, though it is generally used by surveyors of roads and towns; in America the word is familiarly used, in this its proper sense.

GRAFT, To. To graft boots is to repair them by adding new leather outside the worn-out feet of the boots.

GRAVE-YARD. Mr. Bartlett says our English ears, accustomed to the word "churchyard," find "grave-yard" novel. This, at any rate, will strike most English folk as exceedingly novel.

GREASER. A term applied to Mexicans and other Spanish-Americans by the ruder sort in the Far West.

GREASY. The pronunciation of this word with the non-sonant or surd "s" seems to be peculiar to Americans.

GREENBACKS. Legal tender notes. These bills are for single dollars, two dollars, five dollars, ten dollars, twenty dollars, a hundred dollars, and higher amounts. Until about 1877 or '78 smaller coins had their paper representatives, down to ten cents, or fivepence in English money.

GRIG, To. To vex or irritate. In provincial English, *to grig* is to *nip* or pinch.

GRIPSACK. A hand-bag or satchel. Bartlett omits this word from his Americanisms; and I have seen it deliberately quoted as the *English* for what Americans call a satchel. But the word has never been used in this sense in England, except as a borrowed Americanism. That it is not an old-fashioned English word is shown by its introduction as the name of a trumpet in the language of the winged nation discovered by Peter Wilkins.

USE AND BEAUTY IN MATHEMATICS.

READERS of KNOWLEDGE are aware that I brought out in these pages, and have since republished, in a single small volume, a series of "Easy Lessons in the Differential Calculus," whose purpose was to encourage young mathematicians to study a method of calculation exceedingly useful in all departments of research to which mathematics can be applied. I did not raise the question whether the study of mathematics is chiefly to be valued for the help which mathematical methods may afford the student of science, or for its effect in training the mind to exact reasoning. I simply noted that numbers who have occasion to use mathematical methods are deterred from the study of the Differential and Integral Calculus by the supposition that it is not a mathematical system readily available in researches depending on calculation. For such students I wrote, proposing to show them that the Differential Calculus is as *directly* available as an aid in scientific researches and calculations as algebra or trigonometry. I think I succeeded in showing this. In fact that I did so I can safely infer from the large number of letters which reached me while my "Lessons" were in progress, communications to which, I may remark, the publication of the "Lessons" in a volume was chiefly due.

In the *Practical Teacher* an exceedingly unpractical and, to say the truth, somewhat pretentious critic reviews my little book as if it were intended to strike a blow at a much-loved doctrine of his own, that the learner's object in studying mathematics should be "chiefly disciplinary and only subsidiarily utilitarian" (like most critics of this type, our "practical teacher" writes fearful English) "to acquire that finesse of mental culture which this pursuit alone can impart, that nice logical perception of minute differences, the lack of which constitutes the most distinguishing characteristic of the ill-balanced mind, to demonstrate in short the falsity of Voltaire's foolish remark, 'J'ai toujours remarqué que la géométrie laisse l'esprit où elle l'a trouvé.'"

This critic, whose modesty is as conspicuous as his acumen, may possibly possess that nice logical perception of minute differences to which he refers; but he evidently possesses no perception of marked and noteworthy differences. If he did he would perceive (passing over the distinction between a remark of Voltaire's as to what he had observed and a mere opinion attributed to him) that there is all the difference in the world between encouraging the study of a particular branch of calculation because it is useful and deciding the question he raises—one way or another. The study of mathematics, apart from any idea of usefully employing mathematical methods, may have all the disciplinary and purifying effects the critic in the *Practical Teacher* attributes to it: the men who have chiefly been remarkable for developing the simply beautiful parts of mathematics may be among those whose nice logical perception of minute differences has chiefly charmed an admiring world: or, on the contrary, the study of mathematics of this particular kind (the charm of which, by the way, I probably know much more about than my critic) may tend to impair the mind's powers, and especially that mental common sense on which all real progress in knowledge depends; love for such study may be regarded rather as an appetite to be controlled (and often resisted) than as a taste to be encouraged. But whether one view or the other is right, I have not raised the question in my "Easy Lessons in the Differential Calculus"; and criticism turning on that question is entirely out of place so far as my little book is concerned.

If, however, the general question had been raised by me, my "practical teacher" might at least have put the question properly. It does not require that nice logical perception of minute differences which he lauds to perceive that the utilitarian side of mathematics is by no means limited to the paltry uses and classes of uses mentioned by him—the application of mathematics to problems in chance, to measuring the heights of mountains, to finding the way, and so forth. The utilitarian value of mathematics belongs to the whole domain of science, from the profoundest researches of astronomers, physicists, chemists, and biologists, to the humblest inquiries of every-day observers, from investigations of the infinitely great and the infinitely little to the study of the most familiar objects of every-day life. Newton and his followers, in dealing with the mutual attractions and perturbations of the heavenly bodies, had to use, and on occasion invent, mathematical methods ranging, be it observed, from the simplest to the most complex; but one cannot investigate the movements of a reeling top without mathematical methods, which also range from the simplest to the most complex. I imagine, by the way, that few, even among the mathematicians of Dreamland, can have been more tempted than Newton to luxuriate in mere mathematical reveries, such as have delighted the Hamiltons, Sylvesters, and Henrys: the loving touch with which he presents some quaint suggestion tending that way is at least as characteristic as the quick return which his common sense forces him to make to his actual subjects of research.

I know not that even though the mere moonshiners among mathematicians included the names deservedly held in most esteem among great thinkers, if they could be set above the Newtons, Laplaces, Lagranges, Herschels,* Leverriers, Adamses and the rest, it would greatly affect the question of the general value of mathematics as a means of mere mental discipline. For the number of those who will take any discipline of this sort, with or without any question of the usefulness of mathematics, is very small indeed. And though this may be a very trifling consideration to mere dreamers, it is one which every "practical teacher" ought to take seriously into account.

Having completely missed the whole purpose of my little work, a modest little manual enough, this unpractical "practical teacher" naturally fails to understand the details of my plan. For instance, "why Vanishing Fractions should be treated" he cannot imagine; "they do not swim into the student's ken a tenth as often as do Series, the whole question of which Mr. Proctor entirely ignores." Now, if my critic were only a student of the actual problems which arise in scientific research—in all departments, high and low alike—he would know that vanishing fractions are constantly appearing to perplex the student, and that the power of getting rid of their evanescent qualities, of making them represent something instead of nothing, which the Differential Calculus supplies, is an immense relief to the student. As for Series, no student ever finds occasion to deal with them until he has passed far beyond the stage where the methods of the Differential Calculus first begin to be needed. Series are pitchforked into elementary books on algebra and on trigonometry, and so "swim into the student's ken" quite early in his reading; but he does not, for all that, begin early to want them.

Then my reviewer pretends to be concerned because there is no mention of the Newtonian method for Maxima and Minima; but he omits to point out any reason why the method should be mentioned. My book was not intended

* William Herschel cannot be regarded as a mathematician of power, but John Herschel may justly be so regarded.

to show off knowledge on matters outside its subject. He says, indeed, that I refer to Newton's geometrical methods, but only to show how cumbersome they are. This, however, was not my object. I gave an example of Newton's geometrical method of dealing with a particular problem, and of an algebraical method of dealing with the same problem, and touched in passing on their cumbersome nature, in order to impress on the student the value of a method which deals with all such problems in a simple and easy way.

But my critic shows in an even more marked way his entire misapprehension of my very simple and modest little plan, when he asks why I did not deal with the measurement of arcs, since it is about as important as the measurement of areas. If he knew anything about the Calculus, he would be aware that so soon as the student enters on the determination of arcs, he finds himself confronted by problems of much greater difficulty than are involved in the determination of areas. Passing from the circle to the ellipse, which is next in simplicity of character, he finds that the formula for the determination of an elliptic arc does not admit of integration—being, in fact, the second of the three well-known "elliptic integrals" whose discussion by Legendre, Jacobi, and others has taxed the highest powers of differential analysis.

It will not be thought surprising that a critic who thus misunderstands the whole purpose of the book he criticises should imagine many things which have no existence, and misunderstand whatever can be misunderstood. He says my book is far from justifying "the boast" in the preface, and though the nearest approach to a boast is contained in the sentence, "I have striven in this little work to show at once how and why we want a method of calculation dealing with quantities which vary in value under varying conditions, and how such a method of calculation is to be used in practice." Again, I mention that I took up little of the Differential Calculus for my degree examination at Cambridge; and this clear-minded critic, so keenly conscious of the value of a nice logical perception of minute differences, assumes forthwith that I know no more of the Calculus now than I did then. I add that "what I have since learned about higher departments of mathematics" (for the Differential Calculus is quite elementary) "I have studied as occasion required—the only really effective way of studying mathematics," and my intensely perceptive critic finds the meaning of this simple statement beyond his utmost powers of conception.

When critics of this sort are coarsely rude, we must not blame them as we would others. But we must not, therefore, refrain from pointing out where they show coarseness or ill manners. My "practical teacher" is not content to criticise and misunderstand; he is not satisfied to blame as if his *ipse dixit* alone settled the matter; he adopts the method of the vituperative costermonger, who by his "That 's just like *you*, Bill," conveys at once the idea of blame and the suggestion of continued misconduct. The *Practical Teacher*, assuming the weekly charge for learning manners not wasted in the case of its writers, ought to know that to describe what a writer says as "eminently characteristic," with the evidently underlying idea that that is, of itself, to condemn it, is unworthy of a respectable publication, for it is altogether ungentlemanly. We look for such tricks at Billingsgate, not among decent members of society, or in sedate and well-mannered journals.

I admit, however, two characteristic peculiarities in my method of teaching, which persons who can recognise minute differences, but fail to see large ones, may recognise as signs of self-conceit. *Whenever* my own experience has taught me anything, whether it has taught me that I have been right, or that I have erred, I always say as much; and again, when an opinion is based on my own researches only, I point this out—a *Saturday Reviewer* or a too confident *Practical Teacher* says, "It *is* so and so," and as he does not mention himself, the average mind says, "He is not egotistical, he knows." I prefer to say, "It appears to me, so far as my own researches have extended, that the case is so and so," and because I mention myself the average mind says, "This man is an egotist." Which way of speaking is really the more modest, I leave the logical mind to decide.

AMERICAN UNION AND IRISH DISUNION.

I AM asked by a military correspondent if I can explain how it is that Americans, who fought so hard to maintain union in their own country, show such sympathy with the efforts of the Home Rule party.

I have never yet met with an American, properly so called, who sympathised in the slightest degree with the followers of Mr. Parnell. There *may* be some Americans who are misled by the clamour of the newspapers, nine-tenths of which owe the bulk of their political articles to Irish writers. And there are certainly many politicians who, in their public utterances, cater for the Irish among their constituents. But, from the multitudinous conversations I have had with Americans on the subject of England's difficulties with the Irish, I am convinced their strongest anti-British feeling in this matter amounts to nothing more than a lively sense of amusement that the old country seems likely to be hampered and worried into concessions and compromises precisely as the United States have been. That Irish section in America (unfortunately, far the largest) which corresponds with the present Home Rule party and the old Repealers, plays the same game of disturbance there which the followers of Parnell play here. They practically sell their support to the party which will pay most for it—and this alike in national politics, in State legislation, and in municipal matters. Irishmen of this type (most emphatically I do not mean the Irish *race*) seem incapable of higher or worthier policy. Unfortunately they too often get their way in America; just as in the old days of corrupt elections, men who were ready to sell their votes, were too often able to secure their price. The only proper remedy would be that sets of men guilty of this particular form of corruption should be, for a while, deprived of their votes, precisely as corrupt boroughs were in the old times.

The position of American newspapers in regard to the Irish question is well illustrated by an experience of my own. At the last election but one, when it seemed likely that the Home Rulers would be offered the bribe they had so long hankered for, I chanced, in the course of a letter to the *St. Joseph Herald* (written from England) to touch on the iniquity that concessions should be made for the sake of a party's votes, and apart (as former action showed) from any reference to the interests of the nation—asking in what this differed, except in scale, from common bribery and corruption. My letter appeared, only through a lucky or unlucky chance in all probability. But immediately the editor was called upon by indignant Irishmen, and told that unless he excluded thenceforth my name from his columns not an Irishman in Missouri would continue to subscribe. As my letters were practically a present to the paper, and only written at the editor's special request—the paper being of the nonpaying sort—I was no loser, but the reverse, when the editor carried out the wishes of his constituency. But the case illustrated strongly the subser-

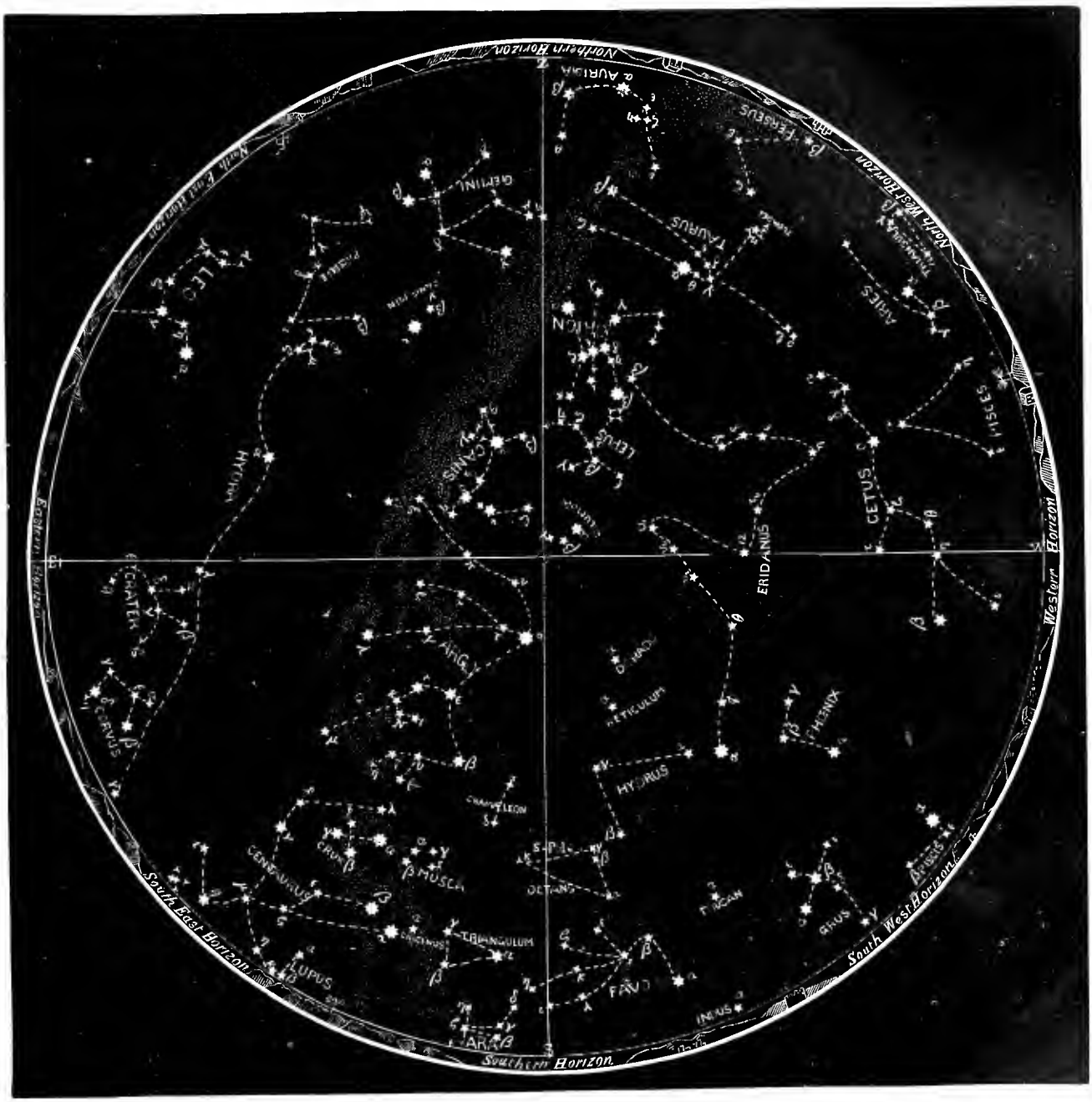
vience which many American editors are disposed to show to their Irish constituency.

I think that at heart Americans, North and South, value union chiefly because it keeps the nation great and strong, and safe from interference. It may be that, even as many in England foolishly imagined that the separation of North and South must be a gain to the old country, so some in America may imagine that were Ireland separated from England America's position would be improved. I have not, however, met with any Americans quite so foolish.

THE ONE-SCALE ATLAS.

THE SOUTHERN SKIES.

MAP XIV.—FOR NOVEMBER, DECEMBER, AND JANUARY.



THE NIGHT SKIES IN THE SOUTHERN HEMISPHERE (LAT. 46° TO 24° S.)
AND THE
SOUTHERN SKIES IN ENGLAND (UPPER HALF OF MAP ONLY) AT THE FOLLOWING TIMES:

At 1 o'clock, morning, Dec. 7.	At 11 o'clock, night, Jan. 7.	At 9 o'clock, night, Feb. 7.
„ 12.30 „ „ Dec. 14.	„ 10.30 „ „ Jan. 15.	„ 8.30 „ „ Feb. 14.
„ Midnight, Dec. 22.	„ 10 „ „ Jan. 23.	„ 8 „ „ Feb. 22.
„ 11.30 o'clock, night, Dec. 30.	„ 9.30 „ „ Jan. 30.	„ 7.30 „ „ Mar. 1.

STAR MAGNITUDES.

First . . . . ✱ Second . . . . ★ Third . . . . ★ Fourth . . . . + Fifth . . . . ▲

IS THERE ANY SCIENCE IN WHIST?

WE have received the following exhilarating letter from a correspondent who evidently does not appreciate "Our Whist Column":—

Exactitude being the chief corner-stone of science, ought the word "scientific" to be applied to a game, of which a haphazard groping in the dark is a chief characteristic? This is a question that recurs to me each month after a perusal of the Whist articles in KNOWLEDGE. Meanwhile I wonder how long there will be persons who entertain the belief that there is some high level of this happy-go-lucky game to which they attain, whilst they look down with contempt on what they style "Home Whist."

Whist, indeed, is a game of such complexity, the whole thing being worked, too, so much in the dark, that the "superior" player never discovers that he is living under a delusion; and, if he cannot show by final results that his play is more successful than the commonplace play of Mr. Humblemind [but Mr. Bumblepuppy never has a humble mind] "he falls back on his *bad luck* for an explanation."

But is it possible that the human mind can go on deceiving itself in this way? Certainly it may; for is not the great whist player who lives in such delusion in the same boat with many other classes? For instance, there are those men who set themselves up as judges of horseflesh; they never in the slightest degree realising the *complexity* of the subject on which they pronounce their confident judgments, though it is perfectly clear to a man of discernment that the intrinsic value of an individual horse as a useful animal can only be discovered by long-continued trial. Politicians and philanthropists, again, deal with questions of great complexity without even for the most part ever discovering that they are so. No failure in the past abates their confidence as they press forward with one idea in their heads. Then there is the weather prophet. He, deluded creature, will call his forecasts "scientific." His case clearly justifies the belief that there can be men who hold that they play a superior "scientific" game, when in truth their play is in effect in no wise superior to that of any person with a passable memory, who can keep his mind on the card-table, and who properly appreciates the old proverb about "a bird in the hand."

Self-delusion being the explanation, we need not be astonished at what would otherwise be very surprising, namely, new orthodoxies springing up in whist, over-confident people now putting forward fresh discoveries, which they suppose to have been overlooked by hundreds of thousands of players of past generations, who gave up almost their whole minds and time to the game. Neither need one wonder at seeing each high priest protesting that the other high priests have really no scientific knowledge of the game on which they presume to instruct the laity. FRANCIS RAM.

Mr. Ram need not have been at the pains to go so far afield for illustrations of persons who knowing nothing of a subject delude themselves into the belief that they know a good deal. Every paradoxist shares this delusion, and internal evidence might have shown Mr. Ram how natural it is.

I may state one or two facts which should help to put Mr. Ram right, only I fear he will not accept them.

First, scientific play does not depend quite so much on imaginary advantage as Mr. Ram imagines. The matter has been put to the test in the most crucial manner—scientific play being matched against unscientific over the selfsame hands dealt in the usual way to a set of players in one room, and repeated card for card for players in another room, and the superiority of science thus tested has come out in a way which surprised even experts. The details of the experiment are given in "How to Play Whist," pp. 199 to 201. Suffice it here to say that, in all, sixty-six hands were played, absolute equality being secured in regard to cards; and the scientific players came out *eleven* points, *one* rubber, and *twenty-one* tricks ahead of the unscientific! Of course, the estimate by tricks is the truest; and it is remarkable that, although, as luck would have it, the cards were very unequally divided in the two rooms, insomuch that in one room the good players were eighteen points *ahead*, while in the other they were seven points *behind*, they came out ahead, *as regards tricks*, in both rooms, being nineteen ahead in one room, and two ahead in the other!

In passing, I may note, that I, of all men, least deserve to be charged with despising Home Whist, having written a little book under that name for the special inculcation of correct play. For two years past I have enjoyed sounder and better whist in my home circle than I have ever had or have ever seen played (in so many as half a dozen consecutive sets) at any club. I have seen sound play matched against the clever plans of first-rate players of their own hands (or "bird-in-the-bush" players) for game after game, till the tricks (honours being left uncounted) have amounted to thousands, and with as steady a gain by scientific play at rates ranging from 8 to 12 per cent., as though the cards had been packed to secure it. I have seen scientific combined play matched against the uncultured whist of a keen card player having single dummy for partner, and even here, where the odds are supposed to be nearly 10 per cent. in favour of dummy, scientific play has prevailed decisively (about 9 per cent.). At double dummy, of course, science is everything, and it very seldom happens that even at a single sitting of any length science is beaten by lucky cards.

But in fact scientific players can recognise every trick secured by sound play or lost by irregular play. When an opponent, by playing out his aces and kings, gives up command, and lets long suits come in and make trick after trick, the scientific player does not need much of his science to see how his gain has been made. When a clever bumblepuppist craftily leads a singleton and rejoicingly makes his ruff, the scientific player knows just how it has happened that through that too clever dodge three or four tricks have come to him which otherwise he would never have made.

If Mr. Ram has ace, queen, and a small one of a suit, and the eleventh round has come, the enemy on his left holding (to the knowledge of every observant player at the table) king, knave, and a small one, he makes his bird in the hand the ace, lamenting only his bad luck, not his feeble play, when two tricks go to the enemy; but if, under like circumstances, a correct player leads the small one, and on the return of the suit makes both the ace and queen, nothing will persuade the unskilful player that the result came from no groping in the dark, but was simply inevitable, and as obvious beforehand to the sound player as the sun in a clear sky. Even if by some amazing chance one can show a player of this sort that in such a case science has saved a trick which nescience would have thrown away, he cannot see the importance of the point. "A trick here, or a trick there, what can that matter?" he will say. "Why, you yourself admit that by bad play a trick may be made which sound play would have lost. One set of casual tricks balances the other—for anything you can tell," and so forth. But that is just what science knows not to be the case. The scientific whist player can look on complacently when bad play wins a trick here or a trick there, knowing that in the long run all *such* gains are balanced by corresponding losses; the scientific whist player can in like manner complacently see play which he knows to be best five times out of nine, turn out badly four times for every five times that it turns out well; but science knows assuredly that every trick made by scientific play where unsound play would have missed it, is so much to the balance of gain which in the long run is bound to stand out beyond the gains and losses either way depending on the mere run of the cards.

As regards his closing remarks, that authorities dispute

over the scientific principles of whist, I need only say that Mr. Ram must be quite unacquainted with the literature of the game. There are not two opinions on any one of the leading principles of whist play. The questions which Mr. Ram has seen discussed have had about as much to do with whist science as a discussion about the best pattern for the backs of cards would have had. All the discoveries which various writers on whist have claimed to make have related to methods of indicating the nature of the players' hands without actually showing the cards. The science of whist indicates the best way of playing such and such cards under such and such conditions. Experience and practice enable good players to infer where the cards lie, and so to ascertain under what condition they are pursuing their strategy. Methods have been devised (more or less recently) for showing certain details of a player's hand independently of inferences based on his strategy. The differences of opinion which have arisen respecting these methods relate to no principles of whist science, but to the questions: First, whether the game is improved or impaired by devices which tend to assimilate it to double dummy; secondly, whether the greater advantages which skilful (as compared with unskilful) players may gain from such devices are fair advantages; and thirdly, whether, with players of average skill more is gained by informing partner about details of one's hand, than is lost by giving the opponents that information.

The fact that I am bringing out in these columns the whist science of old Mathews as well worth studying by modern players, shows how little the principles of scientific whist have changed since Mathews' day. But I am no more at issue with any of the leading whist-players of to-day about whist principles than I am with Mathews or his predecessor Hoyle. (Here and there views have changed about some detail or so, depending on nicely balanced chances—as in the case of the old lead of Queen from Queen, Knave, nine, now only adopted on special occasions, and in regard to covering an honour with an honour second hand; but I have been speaking of leading principles.) With regard, however, to the signalling methods now in vogue, and little likely to be given up, I certainly hold strongly now by the opinion that, though they have introduced no new scientific principles (nor have been advanced, I suppose, with any idea of changing the principles established of old), they have greatly injured whist as a recreation. Weak players have become relatively weaker since they consented to let these signals be introduced—precisely as they would become relatively weaker still if they allowed kicking under the table, significant coughing, sneezing, drumming, and the like, to be adopted as systems of legitimate signalling. They would become weakest of all if a kind of whist were introduced which would be the most difficult and the most scientific game of all—whist in which all four hands were displayed as they practically are in double dummy, but four players were engaged as in common whist. This, by the way, would be a magnificent game so far as its dependence on skill was concerned: but as a recreation it would be altogether inferior to whist as ordinarily played.

Lastly, I may remark on the idea underlying Mr. Ram's letter, that where there is chance there can be no science, because there can be no exactitude. Science seldom secures exactitude, though it strives after it. But if there is a subject about which science is exact, it is in the existence of law in chance results. A game depending on the throwing of dice may be a pure chance game in one sense; but the player would come out badly in such a game who should fail to recognise the exact scientific value of the chances involved.

WATCHED BY THE DEAD.

NOW in "Edwin Drood," the first part of the story, that is the part which ends with the disappearance of Edwin and the close of the sequent inquiries (constituting the first sixteen chapters), forms but one-third of the book as left by Dickens. Had no more been written more might still have been guessed as to the interpretation of the mystery than could have been readily guessed about the "Moonstone" mystery if only the first part of Mr. Collins's story had been completed. Apart from the feeling, not to be explained or communicated, which assures those who understand Dickens's manner and know the meaning of his tones, that Drood is not dead though changed, there is clear evidence not only that Drood is alive, but that Grewgious knows Drood is alive.

We will note first what every reader ought to note, though somehow it has been overlooked by many; we shall then touch on a circumstance which might naturally enough escape notice, though when once noticed it is decisive.

Grewgious is not a suspicious man, though keen and observant, with a very strong sense of what is just and right. He had had no suspicions of Jasper. The interview between him and Jasper in Chapter IX.—the last before the disappearance of Drood—is perfectly friendly. Nay, Grewgious, a man who could not pay compliments, says in that interview, "Come, Mr. Jasper; *I know your affection for your nephew*, and that you are quick to feel on his behalf." When Jasper accepts the compliment "with a friendly pressure of the arm," Mr. Grewgious "nods his head contentedly." He shakes hands in the most friendly way with Jasper at parting, though rather quickly correcting Jasper's "God *save* them both" into "God bless them both." Contrast this with Mr. Grewgious's behaviour when next they meet, and we feel at once that Grewgious has learned, *somehow*, that Jasper is the wretch we know him to be—or, as he puts it later, that Jasper is a wild beast and a brigand. A very short time has passed since their friendly interview; nothing has ostensibly happened to shake Grewgious's confidence that Jasper loves Edwin Drood; and Grewgious is understood to have every reason to regard Jasper with special sympathy. For Jasper's well-loved nephew is supposed to have been murdered; and for many hours Jasper has been "working and toiling" to find traces of his nephew—"now in barge and boat, now ashore among the osiers, or tramping amidst mud and stakes and jagged stones in low-lying places, where solitary watermarks and signals of strange shapes showed like spectres." He has just returned home exhausted—"unkempt and disordered, bedaubed with mud that had dried upon him, and with much of his clothing torn to rags." Surely a man to be very much pitied by Grewgious, who "knows his affection" for the missing man. Nothing but absolute certainty that Jasper is a murderous villain could now prevent Grewgious from showing him such sympathy as even Crisparkle, angry though he is at the suspicions cast on Neville Landless, does not refuse. (It is important to notice that Mr. Grewgious knows little or nothing about Neville.)

So far, however, from showing any sympathy with this unkempt, exhausted, and miserable man, Grewgious is curtly abrupt at the very beginning of the interview, and shows a hardness and cruelty to Jasper as it proceeds such as nothing but the absolute certainty that he sees Drood's would-be murderer before him could justify. Grewgious, who knows scarcely anything about Neville, has no special reason to be angry at suspicions cast upon that young man. Yet every word of Jasper's implying suspicion of Neville, however indirectly, is sharply corrected. "Have you seen his sister?"

Jasper asks, Neville's name not having yet been mentioned. "*Whose?*" asks Grewgious, curtly and turning his eyes with exasperating coolness on Jasper's face. "The suspected young man's," Jasper replies. "Do *you* suspect him?" Grewgious asks.

But even this is little. Grewgious has come to tell Jasper that which, if Jasper were innocent, would only interest him, and would certainly not be particularly distressing in the midst of the intense anguish and suspense Jasper is supposed to be enduring—viz. that Edwin Drood and Rosa were no longer betrothed when Drood disappeared. Only if Jasper had murdered, or supposed he had murdered, Drood, because of a furious hatred of his nephew as betrothed to Rosa, would the information have any special significance at all. But if *that* were so, it would indeed be a terrible blow to Jasper. It would not only show him that he had plotted, and so far as he knew carried out his murderous scheme, against a man of whom he had no reason to be jealous, but that actually his murder had helped to remove an obstacle from the path of a more dangerous rival.

Now, if we merely note that Jasper receives Mr. Grewgious's news with horror, we find nothing particularly significant in this scene. But there is much more in it. Grewgious *knows* that his news will be received with horror. He warns Jasper of this, and even offers to put off the communication till the morrow, possibly because he feels a pity for the weary wretch before him, villain though he knows Jasper to be. But as Jasper concentrates his attention to listen, Grewgious resumes his determination, "with compressed and determined mouth, *now*," he looks at the fire, as with provoking slowness and "internalness" he opens the statement. As he reaches the part which will move Jasper, Grewgious "looks fixedly at him sideways." Jasper's face grows ghastly before him; but he has no compunction. Sentence by sentence he strikes the wretch, till at last he "saw no ghastly figure, sitting or standing; saw nothing but a heap of torn and miry clothes upon the floor." "Not changing his action even then, he opened and shut the palms of his hands as he warmed them, and looked down at it." If Grewgious did not know him for the murderous wretch he was, his treatment of Jasper here, and afterwards, is sheer brutality; yet Grewgious is a kindly man and a gentle. It is absolutely certain, then, from this scene alone, that Grewgious knows what Crisparkle, Neville, and the rest do not know, or even suspect, that Jasper himself has striven to murder, and in intent has murdered, Drood.

From whence can Grewgious have learned this? He might have learned some few facts from Rosa which would suggest suspicion—as that Jasper was jealous of Drood, that she herself had an indefinable and inexplicable dread of her music teacher, nay, that she had striven to warn Drood against Jasper. But even if we were not clearly told in Chapter XX., six months after the disappearance, that Rosa was ashamed of her own suspicions (mistakenly judging of Jasper's conduct by such rules as might apply to average men, but not to "a horrible wonder apart," like him), we should be sure that nothing which so delicate and sensitive a mind as hers could have communicated to Grewgious would have sufficed to convince him that Jasper was Drood's murderer. The knowledge of which Grewgious made such terrible use might, of course, have come from Rosa; it would, indeed, have very naturally been imparted to him by her: but his knowledge that it would torture Jasper, his certainty that Jasper deserved to be so tortured, his manifest conviction that Jasper was a murderous villain deserving no mercy, *these* could not possibly have been derived from anything Rosa had said to him. We might interpret part of Grewgious's conduct, indeed, by supposing that while he had learned from Rosa about the breaking off of the engagement, he had also discovered that Drood had been murdered, and murdered by Jasper. This, of course, might easily have happened. Durdles, with that curious gift of his, by which he could tell when there was anything inside a tomb (a gift enabling him, in one specified case [see Chapter V.], to find how one of his workmen had left some rubbish in a six-foot space inside a tomb), might well be supposed to have discovered Drood's body, and the quicklime cast over it by Jasper, on the very night of the murder (assumed, on this view, to have been accomplished), and he might have brought to Grewgious convincing evidence that Drood was killed, and that Jasper had done the deed. This would account for everything we have thus far mentioned. But this explanation must, for another reason, be absolutely rejected: it will not hold water for an instant. If Grewgious (to say nothing of Durdles) knew that Drood was dead, even without knowing further that Jasper had killed him, he would assuredly not have let the matter rest here. He is a man singularly obedient to the dictates of duty; and he would know that duty imperatively required him, in the case supposed, to make known such facts as this explanation assumes him to have learned. It would have been utterly inexcusable, nay, it would have made him an accessory after the fact, and have been justly punishable as a crime if he had not brought his knowledge at once to light, while the evidence which had satisfied him still remained available for the purposes of justice. We may set the idea utterly on one side that Grewgious knew Drood to have been actually murdered by Jasper.

Since it is certain that Grewgious, during this remarkable interview, knows Jasper to be a murderous villain, while it is equally certain that he knows Jasper is not actually a murderer, nothing remains but that we should conclude that Grewgious knows Drood to be alive while he also knows him to have been murderously assaulted by Jasper, nay, flung into the tomb, after the jewellery so well known to Jasper had been removed. Grewgious would know also that Jasper supposed he had heaped quicklime over Drood's dead body, so that all trace of that body and of its clothing might in a few hours be destroyed. For we know this to have been part of Jasper's plot; and manifestly Grewgious knows everything Jasper had plotted.

While thus, *and thus only*, can Grewgious's conduct be explained—his torturing Jasper without compunction, on the one hand, and his not striving to bring him to justice on the other—we find here the explanation of a little detail which no one seems to have specially noticed, though it is singularly significant—in fact, absolutely decisive.

Just before Drood vanished, Grewgious had entrusted to him a ring which was the sole memento Grewgious had of Rosa's mother. He had loved her, and loves Rosa because she reminds him of her so strongly. He could hardly bear to part with the ring, even to Rosa. "It was hard," he says, "to lose the ring, and yet it must have gone from me very soon." For it was to be given to Rosa on her betrothal. But he charges Edwin solemnly, "by the living and by the dead," to restore the ring to him if Edwin's engagement to Rosa is cancelled. "Will it come back to me?" he asks himself sadly, when Edwin has taken it away. "My mind hangs about her ring very uneasily. But that is explainable. *I have had it so long, and I have prized it so much!*" (All this means, for all who understand Dickens, that the ring is presently to be in danger of disappearing.)

That ring was not given to Rosa. "Let the sorrowful jewels be," Drood said to himself. He would restore them to Rosa's guardian "when he came down; he in his turn would restore them to the cabinet from which he had unwillingly taken them." "Let them be; let them lie unspoken of in his breast. . . . *Among the mighty store of wonderful chains that are for ever forging, day and night, in the vast iron-*

works of time and circumstance, there was one chain forged in the moment of that small conclusion, riveted to the foundations of heaven and earth, and gifted with invincible force to hold and drag."

Grewgious knows that the ring he so prized has not been given to Rosa. He knows it is not among the jewellery found by Crisparkle in the river. Yet he says nothing! He neither causes search to be made for jewels which were of such interest to himself, nor does he say aught which would lead to this particular clue being so followed that perhaps by its aid the murderer might be brought to justice! We venture to say that Dickens had made no such blunder as this view would imply. It was not without a special purpose either that he dwelt on Grewgious's sorrow and anxiety about the ring, or that he directed the reader's special attention to the ring as eventually to lead to the detection of the criminal. He himself had that ring in his thoughts throughout all the circumstances following Drood's disappearance. He must also have known that though careless readers might overlook the ring, or at least the interest of Grewgious in it, some among his readers would assuredly notice the point.

Grewgious is not careful about the ring, or about the detection of the supposed murderer, *simply because he has the ring back in its cabinet*, and because he knows of Jasper's attempted crime, and of Jasper's stroke having failed of its aim. He says in Chapter XXII. he "holds decidedly that John Jasper is a brigand and a wild beast in combination." Such a man as he would have said nothing like this unless he had known of Jasper's murderous assault on Drood, and of his being to all intents and purposes a murderer. Such a man as Grewgious would assuredly not have suffered the prized relic of his lost love to be in the hands of a villanous wretch like Jasper, or to disappear without an effort to trace it. But he could not have learned anything about the ring, nor could he have learned aught about Jasper's villany, except from Drood himself (for, as we have seen, the mere discovery of Drood's body with the ring upon it is not an admissible explanation).

So much established—beyond, we think, any possibility of question—the explanation of "the Datchery assumption" is no longer difficult. But we believe that this assumption, to use Dickens's own word, can be interpreted independently of the decisive evidence obtained from the behaviour of Grewgious.

We know that the very last reference by Dickens to his story was an expression of anxiety lest, in the treatment of the Datchery assumption in the last chapter, he should have shown too clearly how the story was to be developed. We think the fear was fully justified. For we cannot see how any one who understands Dickens's manner can read that last chapter without being convinced that Datchery is Drood. In the earlier part about Datchery there was more care to conceal his identity. Even a fairly careful reader might doubt whether the character were an assumption at all—except, perhaps, for the obvious fact that Datchery wears a wig of white hair, and the probable circumstance that the eyebrows are dyed black (or they would hardly have been mentioned). Even though the careful reader may decide that Datchery is disguised, he would scarcely be led to conclude that Datchery is Drood, clearly though he may have seen that Drood is not dead. Dickens artfully makes Drood inquire about Mr. Tope as if he knew nothing of the verger, and still more artfully makes Drood lose himself on his way from "the retiring Crozier" to Mrs. Tope's rooms. Of course the inquiry corresponded well with Datchery's obvious wish to conceal his identity; while Drood's losing his way, even if not regarded as part of the same plan, would be only too easily understood by any one who has resided in a cathedral town and knows how readily one may get "very cold indeed" in the search for even a well-known nook from an unknown hotel "of retiring disposition" like the Crozier. (We know Rochester—Cloisterham, that is—pretty well: but we would certainly not undertake to find our way easily through all its labyrinthine passages.)

Of course, with the knowledge that the Datchery character *is* an assumption, as Dickens told Miss Hogarth later, even the scenes in Chapter XVIII. suffice to show who Datchery is. There is no one in the story but Drood himself unaccounted for, except only Bazzard. Now Bazzard is not only a fool, but a dull one, and a curmudgeon; Datchery is neither the one nor the other. Bazzard has no sense whatever of humour; Datchery is full of dry fun. Bazzard is as clearly intended to come to utter grief in the end as was Silas Wegg in "Our Mutual Friend;" Datchery is just as clearly intended to triumph in his plans. One might almost as reasonably imagine that Datchery is Honeythunder as that he is Bazzard.

But in the last chapter of the book the evidence that Datchery is Drood is so clear that no one can doubt its meaning, though many may overlook its existence till it is pointed out.

We would in particular invite all who love the writings of our later "Wizard"—the Wizard of the South—to compare very carefully the scene between the opium-eater and Drood in Chapter XIV. and the scene between the same opium-eater and Datchery in Chapter XXIII. It would not be fair for us to quote, as we might do, sentence after sentence from one scene for comparison with sentence after sentence from the other. Let the reader who has not yet done this do it for himself; he will be well repaid. The close resemblance between the characters of Drood and Datchery will at once be obvious; the humour and the pathos of each will be fully appreciated. Of course, we compare Datchery only with Drood as seen in that last scene before the disappearance, when sad after his parting from Rosa, whom he loves—though even then he does not know it, "the vanity and caprice of youth" (soon to disappear for ever) "sustaining the handsome figure of Miss Landless in the background of his mind." The Drood of the earlier scenes is dead—"Poor youth, poor youth," Dickens says of *that* Drood; and many readers suppose he has condemned Drood altogether to death.

But the closing passages of the two scenes must be quoted to show how absolutely identical are the tones in which Drood and Datchery are spoken of, though of course we cannot make this clear to those who have no ears for such tones:—

From Chapter XIV.

This is not an inspiriting close to a dull day. Alone, in a sequestered place, surrounded by vestiges of old time and decay, it rather has a tendency to call a shudder into being. He makes for the better-lighted streets, and resolves as he walks on to say nothing of this to-night, but to mention it to Jack as an odd coincidence to-morrow; of course only as a coincidence, and not as anything better worth remembering—still it holds to him, as many things better worth remembering never did. He has another mile or so to linger out before the dinner-hour; and, when he walks over the bridge and by the river, the woman's words are in the rising wind, in the angry sky, in the troubled water, in the flickering lights. There is some solemn echo of them even in the cathedral chime, which strikes a sudden surprise to his heart as he turns in under the archway of the gatehouse.

From Chapter XXIII.

Mr. Datchery pauses with the selected coins in his hand, rather as if he were falling into a brown study of their value, and couldn't bear to part with them. The woman looks at him distrustfully, and with her anger brewing for the event of his thinking better of the gift; but he bestows it on her as if he were abstracting his mind from the sacrifice, and with many servile thanks she goes her way. John Jasper's lamp is kindled, and his lighthouse is shining when Mr. Datchery returns alone towards it. As mariners on a dangerous voyage, approaching an iron-bound coast, may look along the beams of the warning light to the haven lying beyond it that may never be reached, so Mr. Datchery's wistful gaze is directed to this beacon and beyond.

Rightly to understand the force of the resemblance between the two scenes, of which these passages are the close, it must be remembered that if Datchery is really Drood, then in each scene we have the same person; in each scene Drood shows the same kindly and considerate way of talking to the old and feeble ("always kindly," we are told of Drood; and as kindly to the child as to the aged, if Datchery is Drood), in each Drood has been reminded by the old opium-eater of his love for Rosa; in the first he had just made the sacrifice of that plighted troth which he had but then learned to value; in the second his thoughts were on that sacrifice—no other—when the old woman thought he was weighing the value of a few coins; in one scene he has a foreshadowing of the danger to be feared from Jasper; in the other he knows the danger he has to face in exposing Jasper for the villain he is. We can understand, then, how it comes to pass that the selfsame tones are heard in both passages throughout both scenes. Even the old opium-eater somehow felt, she knew not how, that the white-haired man addressing her was no other than the "young gentleman" she had met there before.* We must not be duller-witted than she was.

Note, further, that when Datchery had met Jasper without being detected, he regarded that as a difficult task achieved—"For a single buffer, living on his means," he said, "I have had a rather busy afternoon." But after the scene with the old opium-eater, he says of his work, "Hum! ha! a very small score, this; a very poor score." Albeit, when he finds that she has, like himself, a strong feeling against Jasper, he adds "a thick line to the score, extending from the top of the cupboard door to the bottom," and falls to "on his breakfast with an appetite"—these being the very last words of the story, and significant words they are.

Some other points disclosed in the story as written may be noticed here, though, in truth, it would be easy to fill a volume with the consideration of the multitudinous touches introduced by Dickens into this only half-written novel. It is clear that Rosa knows perfectly well that Drood is not really dead. Of course, Grewgious would not let *her* for whom he had such tender and chivalrous feelings remain a moment in doubt on this point. But, apart from that, her whole conduct is inconsistent with the belief that she is as troubled by the mystery of Edwin's disappearance as she certainly would have been, sensitive and tender-hearted as she was, had it really been a mystery to her. Even the way in which she speaks of Jasper to Grewgious as "his uncle," shows that they both think of Drood as a living man. But this is shown even more clearly by the very passages which some regard as suggesting that she sorrows for Edwin as dead. When she is first beginning to be in love with Tartar she thinks of Edwin, saying, "Poor, poor Eddy!" Now, had she formerly loved Edwin, the newly-born love for Tartar, Edwin being dead, would have suggested this thought, naturally enough. But as she had never felt more than a sisterly love for Edwin, it is clear there is another meaning in her sorrowful thought of him; and what else should it be but the thought that *now* there is no hope for Edwin that she ever can love him. She knows Edwin is alive; she knows that Edwin loves her; she has heard this through Grewgious, and has even promised Grewgious (probably) that if ever the time should come when she may feel love for Edwin she will say so. When she comes to Grewgious after Jasper had terrified her, and has begun by saying that "she had taken a sudden resolution," she remembers this promise, and, lest Grewgious should think the sudden resolution related to Edwin, says in the same breath, "Poor, poor Eddy!"—an exclamation which the keen old man is not at a loss to understand, as we note by his sympathetic response. And every expression of regret for Eddy on Rosa's part will be found to relate to her dead love for him, or rather for the love that had never lived.

How, then, was the story to have ended? It appears to us that, independently of what Dickens said to Forster on this point, the end is very clearly foreshadowed. Of the four men who are in love with Rosa, two are to die. Jasper will be driven to the tomb where he supposes Edwin's dust to lie, to seek for the ring of which in due course Grewgious will tell him.* There, seeing his supposed victim (as the outside pictures of the original monthly numbers show Edwin Drood) standing alive and threatening, he would fly with a shriek from the menacing vision, as he would consider it, to be pursued by Neville, Tartar, and Crisparkle (as also shown on the cover) up the winding stairs along which he had led Drood a year before to his doom. In this pursuit, or rather in the attack on Jasper, Neville was to be slain. (No character in all Dickens's novels was ever more distinctly doomed to death, by the clear evidence of the narrator's tones, than Neville Landless.) The death of Jasper was, we conceive, to have been like that of Jonas Chuzzlewit and of Slinkton in "Hunted Down;" Rosa was to marry Tartar; and Helena, Crisparkle. We imagine that Dickens would have found noble exercise for his special powers in showing Neville Landless rejoicing in the happy fortune of Tartar's love for Rosa, though he had viewed so angrily Edwin's seemingly prosperous love, in the days when Edwin was not in earnest and did not even know the love that was in his heart. Edwin was doubtless to remain to the end devoted to Rosa, even as Grewgious had remained devoted to the memory of Rosa's mother. There was to have been no bitterness, however, in Edwin's heart towards Tartar in regard to his own less fortunate love. A certain wistfulness such as we see already in Datchery, and on Rosa's part a certain sad regretfulness—nothing more: nothing to pain those who had followed Edwin's story, more than we are pained by the gentle tenderness of Tom Pinch's love for Mary Chuzzlewit—a love as tender and as pure as his love for her as Mary Graham.

Oyster-opening Monkey.—Mr. Alfred Carpenter, of the Marine Survey Office, Bombay, has observed Macacus monkeys on the island off South Burmah opening oysters with a stone. They bring the stones from high-water mark down to low water, selecting such stones as they can easily grasp. They effect the opening by striking the base of the upper valve until it dislocates and breaks up. They then extract the oyster with the finger and thumb, occasionally putting the mouth straight to the broken shell. The way they have chosen is the easiest to open the shell.

* It was no new idea of Dickens's thus to picture the unconscious influence of individuality making itself felt through all disguise, through all real change of condition. We have already noticed one case—viz. where Mrs. Boffin somehow feels that John Harmon, whom she had last seen and known as a child, is near her, when the real John Harmon is there disguised as the secretary, Rokesmith, and now a man who, though still young, has been made serious and grave by many sorrows. And there are many other examples. Of course we are carefully told that the old woman was reminded of the former meeting with Drood "by the sight of the place." But this is only to blind us as far as possible to the truth that she recalls the former conversation, because, changed though he is in appearance, she is talking to the very man with whom she talked before.

* In the singularly amusing conversation between Grewgious, Crisparkle, and (eventually) Tartar, a conversation in Dickens's best style, Grewgious, in advising that the caller (Tartar, as it turns out) shall be admitted, remarks that it is well to take advantage of any such opening as may present itself. "I could relate an anecdote in point," he says, "but that it would be premature." It is impossible to say what this refers to, but one may guess that perhaps Grewgious when in Cloisterham had looked in at the jeweller's who had talked with Drood about his jewellery, and from him learned (what Drood had learned) that Jasper had a most exact knowledge of all Drood's ornaments. This would have suggested the power of the ring to hold and to bind the guilty wretch.

A STUDY OF CHILDHOOD.

THE profoundest philosophers of our day have not thought it beneath them to discuss matters which are commonly regarded as outside the domain of science, in a truly scientific spirit. Faraday analysed a tear; Darwin has based important theoretical views on the analysis of a smile, a frown, a sneer, a gesture of hand or head or shoulders. Darwin noted in particular the expression of the emotions in very young children—a subject of inquiry of extreme importance when it is considered that, according to the Darwinian theory of the origin of man, we should find in very young children the strongest indications of those characteristics which link the human race with races next below them in the animal world. In the unborn child may be traced the various stages of progress, from the ascidian to fish-like and thence to reptilian forms, and so onwards to the lower and thence to the higher mammalian type. The newly-born child shows in many characteristics, which disappear with advancing years, his kinship to the most advanced mammalian type short of man. As time passes, the simian characteristics are replaced by those which are now recognised only in uncivilised races—the progression not ending in infancy, however, or even in early youth, but (at any rate with the best representatives of civilised races) continuing into middle life. Since our kinship with savage human races is not questioned (though for aught that appears it might very well have been doubted, and is, indeed, as it is, altogether misunderstood by many), there is more scientific interest in the study of the very young child, whose movements and characteristics, carefully observed, throw clearest light on the question of man's kinship with the higher mammalian types.

Hitherto the mental and physical development of very young children has not been systematically studied. Tiedemann, in the last century, gave some attention to the subject, but his work has little value in the present day. In a work of some 440 pages, Professor Preyer, of the University of Jena, made the first three years of a child's life the subject of careful and systematic study. He carefully considered the progress of the child from week to week, or the apparent cessation of progress in various parts of the child's development, and attempted to explain the various phenomena successively observed. It is hardly necessary to say that the standpoint from which Professor Preyer observed and made his inferences was that of the evolutionist. Aided by his study of the ways and habits of the young of lower forms, Professor Preyer analysed the phenomena of the infant mind with a success which perhaps he otherwise would hardly have been able to achieve.

Professor Preyer worked on a single subject—a boy of his own. Here, at the outset, it is to be noticed that while many of his observations may be such as would have been noted in other cases, perhaps in all, observations made on one child cannot possibly be regarded as establishing general laws of infantile development. If we consider how much children differ in such matters as the time when they begin to talk and to walk, we shall see reasons for believing that they differ also greatly in those other matters more delicate of observation, with which Professor Preyer here deals. I have had opportunities of noting the development of fourteen infants, in one family (my own), in which one might fairly expect a greater uniformity than among children of different families; and I can answer for it that the differences as to such matters as first noticing light, distinguishing colour, making first attempts at touching, grasping, and so forth, recognising and responding to varying expressions of the parents' or nurse's countenance, &c., are very great indeed. Professor Preyer recognises this, of course. He knows that such differences exist among the young of all races. He compares as far as possible his own observations with those of others. But it is important to notice how very necessary in this research are abundant observations made on a great number of children belonging to different families.

Almost every day Professor Preyer made observations three times, morning, noon, and evening, on his little "subject." He made experiments, also, unhampered by the customary modes of infantile training, which would, of course, have interfered with his operations. Necessarily, however, he had to rely for some of his observed facts on others. He found an ally in Mme. Preyer, who probably took quite as much interest in the child's progress as he did. Whether on one or two occasions she may not have misinterpreted what she saw in a manner unduly complimentary to the child's intellect, our deponent sayeth not; it seems not wholly impossible.

The first sense considered was sight, though probably feeling is the first sense exercised. He considers that sensibility to light exists from the moment of birth. Yet probably this sensibility is more alive to the sense of feeling than to that of sight. Be this as it may, the infant from the first closed its eyes when exposed to a strong light. With regard to actual sight, as denoted by the fixing of the eyes on objects, Professor Preyer says that up to the tenth day he noticed no movements indicating that the child fixed its eyes on an object. The child seemed only to look at objects before it up to that time. Now here observation will show that infants differ greatly. I am sure some children fix their eyes on objects long before the tenth day; and I knew of one case, a little girl of my own (exceedingly nervous and supersensitive throughout her short life of eight months), of whom I should say that she certainly followed with her eyes in the most definite way a light which was being shifted about in the room in which she was born, when she was less than half an hour old, were it not that the thing seems so incredible I am half disposed to think it can only have been some strange chance which caused her eyes thus to move. During the few minutes that I was allowed by an authoritative nurse to watch the little creature, her eyes while open—say in all some fifty or sixty seconds—were constantly fixed on the light and followed it when it was moved. On the following evening, when she was some twenty hours old, there could be no mistake about it; but during the day (Christmas Day, 1871) I had no opportunity of noting whether objects not so well defined as a light were equally noticed (or rather, looked at, for there may have been no noticing in the matter). Professor Preyer says that a child may "turn its head towards a source of light—as the window, just as it turns its head towards the breast, through an association with pleasure." Yet this, I think, can hardly be the explanation of the observed fact that an infant less than twenty-four hours old turned its eyes on such an object as the flame of a wax candle. In fact, Professor Preyer puts such an observation as this at a much later date. "The second stage," he says, "is reached on the eleventh day, when the child, after staring at one bright object (the author's face), turns the head to another, a light, near it; and the third stage is entered upon on the twenty-third *day*, when the child follows a candle, held one metre (say 34 feet) before the eyes, to the right and left, upwards and downwards, with the *eyes* and without any movement of the head." This third stage, I can answer for it, was entered upon by my little daughter before she had reached her twenty-first *hour*, and unless I was greatly

misled by merely chance movements of the eyes, some twenty hours earlier still.

The last stage of eye direction "is that in which the child is able to turn the eye towards an object, and to seek for new objects in the field of view. This stage is reached (it should be this stage was reached in the particular case in question) in the first quarter. On the eighty-first day, the child turned its eyes seeking an object (a drinking-glass) which was emitting tones."

The power of judging direction and distance is closely associated with these first experiments in seeing. Professor Preyer says that in the sixty-eighth *week* the child still grasped at objects lying beyond his reach. "On this," Mr. Sully remarks, "it seems to me there must be great differences here. I tried a boy of mine with an object when just six months old. If the object was held a foot or less beyond his reach he made no movement. But as soon as it was brought pretty near the accessible point he made a decided grasping movement." A boy of mine, five months and a few days old, amused himself in the early morning hours (much too early for my comfort or his mother's) in grasping and pulling towards him the red lining of our bed curtain, which is carried round the top of his cot. He made no attempts of the kind if (as in the warmer weather) it was placed where it would be some five or six inches beyond his reach. When he was five months and one day old he tried to pull the lining so as to get it into his mouth, but could not, because even with a stronger pull than he could give it would only reach within some three or four inches of his mouth. On this he put two hands down beside him, and, hoisting himself up, laid hold of the lining with his not quite "boneless gums." There must have been some judgment of distance and direction here, because his eyes could not guide the capture, as when it was made with the hands.

Hearing is defective for several days after birth. Young mothers should note this, by the way. I have known cases where a mother has feared that her child was born deaf because it paid no attention to noises not accompanied by movements it could feel. In one sense every infant is born deaf, owing to the condition of the aural conduits: and even when the organs of hearing are no longer impeded there is often no power of discriminating sound for several days.

Professor Preyer found, he says, that "the first unmistakable movements of the head in the direction of a sound occurred in the eleventh week." (This seems not quite consistent with his statement that on the eighty-first day the child tried to look at a drinking-glass which was emitting sound.) At the end of the sixteenth week the movement of the head in the direction of a sound—that is, so that the eyes were directed towards the spot whence the sound came—"had attained the precision and certainty of a reflex movement."

The sense of feeling is next dealt with by Professor Preyer. His observations seem to show that the surface of the body is somewhat less sensitive to touch just after birth than it afterwards becomes. So also the difference of sensibility in different parts of the body increases for some hours after birth. Immediately after birth the body seems almost insensible to variations of temperature, but soon becomes tolerably keen. Thus, when the bath was cooled down to $32\frac{1}{2}°$ centigrade ($90\frac{1}{2}°$ Fahrenheit) the child appeared content, but with a further lowering of $1\frac{1}{4}°$ centigrade ($2\frac{1}{4}°$ Fahrenheit) the child began to cry.

The most perfect sense at birth is taste. "The discrimination of quality, namely, sweet, bitter, salt, and sour, is possible from the first, provided sufficiently strong stimuli are employed. If weak solutions are used the tactual sensation overpowers the gustatory, and the child is indifferent."

The sense of smell seems at first to be associated with the sense of taste. In the seventeenth month, when a hyacinth was held to the child's nose, the youngster tried to take it into its mouth. It is not altogether clear, however, that the sense of smell is distinct from that of taste. Professor Preyer considers that the first odour known to the child, that of its mother's milk, is so inseparably bound up with the pleasure of feeding and the sense of taste, that the child argues in this case the smell is pleasant, therefore this is something nice to eat. But the senses of touch and sight are involved here, and it seems to me, from what I have observed in a great number of cases, that they have at least as much to do with the child's attempt to eat what is offered to it as any sweet smell the hyacinth might have had. If a piece of twisted paper, or a ball of cotton, is held to a child's nose, he will take it into his mouth, though it has no odour, pleasant or otherwise. This habit continues to the middle of the second year, or even later, though after the first eight or nine months the child's wish seems not so much to taste as to test the object presented to it.

Professor Preyer considers that fear is an inherited instinct with young children. Of this there can be very little doubt; though it is to be noticed that children in the same family differ very much as respects timidity, both in regard to the degree of fear they show under the same conditions and to the circumstances which chiefly affect them. In some cases fear doubtless results from association, and may often be ludicrously out of proportion to the exciting cause. A boy of mine who during his first teething had been in charge of a strange nurse, showed signs of anxiety afterwards when she approached, as if (but of course the interpretation may not be correct) he associated her appearance with the pain he had suffered when he first saw her. Professor Preyer says that "the timidity of young children before small animals can only be explained as the result of inheritance." He noticed this first in the ninth month, "and as late as the thirty-third month the child cried in a ludicrous manner at the approach of a puppy only a week or two old." The timidity, here, is rather anxiety in the presence of the unknown and mysterious than an inherited fear of small animals. I have noticed that an anxious, half-frightened (but also half-curious) look always comes over a child when it sees, hears, or feels anything of a striking nature for the first time.

Professor Preyer points out that blinking the eyes on the sudden approach of an object does not necessarily imply an intensified fear of danger. It seems rather to be a result of experience, not being noticed during the first two months, and is therefore presumably an acquired habit. But he regards the fear of falling when the child begins to walk as instinctive. Here, it seems to me, he is in error. If the fear of falling were instinctive, we should, I imagine, see more trace of such fear in very young children when they are held high in the air, and still more when they are tossed up (as some will unwisely do with their children) to the ceiling. But this is not usually, or indeed generally, the case. I hold my youngest boy high up above the ground, and he only crows with pleasure. I let him down suddenly from that height, and he shows no signs of fear, only a sort of quaint perplexity at the sudden change of position.

So, again, I agree with Mr. Sully in thinking that the timidity displayed by Dr. Preyer's little boy in the twenty-first month, when the child was taken close to the sea, is an inherited fear. As Mr. Sully well remarks: "Much of children's early shrinking is undoubtedly due to a kind of shock which is given by certain things. One may easily suppose that the vast expanse of water, especially when attended by movement and the peculiar voluminous sound, would produce such an effect; and it is certain that something of children's fear of animals, especially of dogs, is

occasioned by shock. A boy of mine showed very decided and strong fear," proceeds Mr. Sully, "amounting to childish terror, at dogs, after one of these animals, which had secretly entered the room with his mistress and ensconced himself under the table, suddenly ran out towards the child, barking. 'Bow-wow' remained for months after the type of everything new and disconcerting. When hearing a strange sound he would run to his mother and hide his face, exclaiming 'Bow-wow!' He showed a dislike to worms, which he also called 'bow-wow.' I think that there is no doubt that inheritance played a part here, but something must be allowed for the mere disturbance of the shock. The fact that a child may be completely upset by the father or mother donning a slight disguise seems to me to point conclusively to this. Dr. Preyer's facts on this head are interesting, but hardly full enough. There is no reference to the seemingly whimsical timidities of children towards strangers. My observations have convinced me that there are certain peculiarities of face and tone of voice which at once rouse strong fears in the child; and M. Perez and others have pointed out that young children shrink from persons dressed in black. Would Dr. Preyer say that these are cases of an inherited association?"

MOVEMENTS IN THE STAR DEPTHS.

AMONG the many contrasts between the seeming and the real presented by the teachings of astronomy, there is not one more surprising than the contrast which exists between the seeming fixity of the stars and the tremendous velocities with which in reality every star is urging its way through space. For what evidence could be more convincing, it would seem, than that which the study of the heavens has afforded in support of the theory that the stars are fixed? Thousands of years ago the constellations are as they now are; Orion with its belt, the seven stars of the plough, Cassiopeia's chair, the garland of stars in Perseus, the Pleiades and Hyades, all the principal star groups were figured by ancient astronomers as we should figure them now. Where else can we find such stability? And if, in thousands of years, the star groups have not changed in form, how can we reconcile the evidence of fixity with the assertions of astronomers that all the stars are in rapid motion, and some certainly moving so swiftly that no form of motion known to us on earth is comparable with these tremendous velocities?

The answer to these questions is exceedingly simple. Indeed, the whole subject of the stellar research depends on very simple conditions; for the magnificence of the problems involved prevents the astronomer from dealing with any but those more striking features which can be considered without the use of complex or recondite methods.

The fact is, then, simply this, that the stars are so far off that their motions, though inconceivably swift, produce no change of place which ordinary observation can recognise. The effects of motion are reduced by distance, precisely as the dimensions of an object are reduced. As a ship on the horizon, though she may be urging her way swiftly through the water, yet seems at rest, so the distant stars seem unchanging in position, though in reality they travel many miles in every second of time.

It is indeed worthy of notice that the effect of the enormous distances of the stars in diminishing their apparent motion is the exact counterpart of the effect of the same distances in preventing any appreciable stellar displacements on account of the annual motion of the earth in her wide orbit. These two circumstances correspond in every respect. We read with astonishment in our own books of astronomy that, though the earth's orbit has a span of 185,000,000 of miles, yet even the nearest star is seen in apparently the same direction (so far as any but the most delicate instrumental observation is concerned) from opposite sides of this enormous path. But we should observe that it follows as a direct inference that if a star travelled as many millions of miles athwart the line of vision it would seem to be unchanged in position, even though that star were the nearest in the heavens.

So that we perceive at once how little reason there is for inferring from the seeming stability of the star groups that the stars are at rest. The great marvel of all is that the groups remain unchanged in appearance during the year, though the earth shifts so enormously in position. That fact is the true basis of all our ideas respecting the vastness of the stellar measure, and once this vastness is recognised the wonder rather is that any stars should seem to move at all than that close telescopic scrutiny is required to detect stellar movements.

If astronomers could only apply the same process for recognising stellar motions which they have to apply to examine the distances of the stars, we should know very little about the movements of the stars. It is not commonly known how little has been really done by astronomers to determine star distances. There are not four stars in the whole heavens whose distances have been satisfactorily determined; and there are not twelve which, under the most rigid scrutiny, have given even the slightest signs of having a measurable distance. All the host of heaven, save these few, all the thousands of stars seen on the darkest and clearest night, all the millions revealed by the telescope, and all the millions on millions of them which no telescope yet made by man can reveal, lie at immeasurable distances. And yet the measuring line which has been used is of inconceivable length. A single length of it brings us to the nearest star, Alpha Centauri, more than 200,000 times further away than the sun; another length added brings us to two other stars, one lying in the Swan and another in the Great Bear; and astronomers know pretty certainly that from three to ten or twelve lengths of this enormous line would give a distance within which lie all the twelve nearest stars. But they have no means of pushing their measuring rod further out into space. Not only can they not do so now, but it is unlikely that any improvements in telescopic construction will enable them to do so at any time.

But the stars whose motions have been recognised are not some ten or twelve, but are counted by thousands, and there is every reason to believe that astronomy will one day count them by tens of thousands.

The reason of this difference between the mastery which astronomers have obtained over one problem while its sister problem remains almost untouched is easily presented.

To determine the distance of a star the astronomer must determine a difference in the star's direction, which is repeated oscillatingly year after year. If we imagine a line drawn from the star to the earth, the earth end of the line would travel round and round in a circle 185,000,000 of miles in diameter, the line itself swaying like a gigantic pendulum, and the effect to the observer on earth would be precisely as though the star were travelling round and round in a circle 185,000,000 of miles in diameter, a line from the earth to the star swaying like a gigantic pendulum. It is the sway of that pendulum that the astronomer has to measure, and how small that sway is will be understood when I mention that in the case of the nearest star it corresponds to the motion of the minute hand of a clock or watch in the 200th part of a second.

But in the case of a star travelling onward with enor-

mons velocity through space, it is not an oscillating but a continuous motion that has to be determined. In a year this motion may be less (and curiously very much less) than the annual swaying motion of the nearest star. But in the course of many years it becomes measurable or even (in the astronomical sense) considerable. We speak of the astronomical sense, meaning the way in which an astronomer considers displacements, which to ordinary observation are altogether inappreciable. With the telescope, magnifying such displacements several hundredfold, and also supplying the most delicate means of testing displacement, a change of place equal to the hundredth part of the moon's seeming diameter, instead of being barely discernible (as it certainly would be to the unaided vision) is a phenomenon altogether obvious and startling.

Even so, however, by far the greater number of the stars move so slowly on the heavens that the lifetime of a single observer would be insufficient for an exact determination of a star's rate of (apparent) motion. There are some few stars indeed which are moving with abnormal rapidity; and these could have their rates determined in twenty or thirty years with great accuracy. Yet even among these the amount of change in an ordinary lifetime seems surprising small. For instance, the star which moves most rapidly of all—not a bright and conspicuous star as might be supposed, but a star so faint that it has not been thought worth while to give it a name in ordinary star lists—moves in sixty years over a distance less than one-fourth of the moon's apparent diameter. So that if an observer twenty years old noted the place of this star, and in his eightieth year observed it again, it would be that seemingly insignificant arc which he would have to measure—not to *recognise* such and such a displacement, but to *measure* its amount with accuracy.

Of the real rates of stellar travelling we can form no exact ideas, simply because the stars' distances are unknown. There is a method by which the rates of stellar approach and recession can theoretically be determined; but as yet it has not been applied with anything like exactness.

It appears probable that the average rate of stellar travel is about twenty miles per second, a wonderful velocity if we consider that each star is a sun like our own, and that, like the rest, our sun, with his family of planets, is travelling with kindred velocity through space.

Gossip.

By Richard A. Proctor.

I write my Gossip for this month "by Susquehanna's side," at Wilkes-Barre, Pennsylvania, and in a hotel called "The Wyoming Centre." As I write, a wretched steam-whistle is sounding out the signal demanded by law when steamers on a river sight each other; but otherwise, as the shades of evening close over the scene, it is easy to conceive that in the days of the imaginary "Gertrude" the valley of the Susquehanna looked much as it appears before me now, save for a very modern and business-like bridge just within sight on the right.

* * *

The story is a touching one as Campbell tells it. It is a slight matter that Wyoming is never pronounced Wy'oming, as the rhythm requires in the line

On Susquehanna's side fair Wyoming;

but always Wyōming. Unhappily, there is a much more serious detail in which reality and the Gertrude story are at issue. Campbell remarks, and might with fair reason have remarked, had he ever visited the Wyoming Valley, that "though the wild flower on the crumbled wall" and "ruined homes a sad remembrance bring" (so nearly as my memory serves me) "of what thy gentle people did befal, yet thou," meaning Wyoming, "wert once the loveliest land of all." It rather destroys the charm of the legend to learn, as is well known here "by Susquehanna's side," that of the three hundred and more who went forth to attack the Indians on that sad occasion, barely thirty were sober—all the sober ones, by the way, escaping with their lives. The descendants of the old settlers are a little sore when the real inwardness of the old Wyoming story is mentioned, though many of them must of course be descended from the sober thirty.

* * *

A correspondent sends me a cutting from the *Spectator*, in which a certain explosive is described which can produce its full effects without any heavy substance like cannon, mortars, or the like, from which it need be discharged. From a paper tubing it would be as effective as from a twenty-ton gun. Hence certain direful effects are anticipated for nations like the Swiss, who have hitherto owed their safety solely to the difficulty of conveying artillery into their mountain fastnesses. My correspondent asks whether such an explosive and such singularly "light" artillery are possibilities. They will become so when "action and reaction" cease to be equal and opposite; that is, *never*.

* * *

Another correspondent asks me whether I consider the influence of the moon on the weather worth the attention given to it in a recent number of *Longman's Magazine*. Since I consider the influence of the moon on the weather as nearly as possible *nil*, it should hardly be necessary for me to say that I do not. Regarded as superstitions belonging to the old time when the moon shared with the sun and planets very potent influence over man, the fancies about the moon's weather significance are quaint and amusing enough. But it would be a waste of time to consider whether after all there may not be some meaning in them, since, without a single exception, they bear the clearest traces of their unscientific origin.

* * *

There is one lunar fancy only which has (though its inventors knew nothing of this) a quasi-scientific interpretation. I refer to the notion that if the old moon is seen very distinctly in the new moon's arms wet weather will probably follow. As I pointed out many years ago, illumination of the moon by the earth, when, the moon being "new," the earth is "full" to her, must be to some degree greater when the earth's sunward face is cloud-covered—and as that face lies west of the observer's station when the new moon is seen in the west (the sun having recently set) we have in the brightness of the old moon in the new moon's arms a certain indication of cloudy skies west of the observer, whence usually weather travels. But those who know how persistently the old moon is seen clearly and strongly, even to the time of the moon's first quarter, in countries which have clear skies, while in hazy climes the old moon is seldom seen, must feel well assured that the distinctness of the old moon depends far more on clearness of sky than on any increase in the amount of "earth shine."

* * *

A correspondent would like to see that explanation of an ice yacht's travelling faster than the wind, to which reference is made in my article on the curve in base-ball. In one of the first few numbers of Knowledge such an explanation is given. It may suffice to note here that with a strong beam wind, if an ice yacht travels no faster than

the wind, she is practically sailing 45 degrees or four points from the *effective* wind resulting from the combination of her own speed with the winds. If her speed is increased, she is sailing closer to the effective wind. But an ice yacht, which makes no way, and is little resisted by friction, can sail much closer than four points to the effective wind—in other words, her velocity will continue to increase long after she has attained a velocity equal to the wind's.

Reviews.

Unfinished Worlds. By S. H. PARKES, F.R.A.S., F.L.S. (London: Hodder & Stoughton. 1887.)—It is not, at first sight, very easy to see the *raison d'être* of Mr. Parkes's volume, inasmuch as he simply reproduces (not even always correctly) facts to be found in every modern work on popular astronomy extant. The most apparently obvious motive underlying his work would seem to be that of bolstering up Sir J. W. Dawson's weak and inept attempt to disprove the antiquity of man on the earth. But, having said this, we must in candour add that our author describes the objects of which he treats picturesquely enough, and that the perusal of his book by those approaching the consideration of its subject for the first time will be very likely to implant or stimulate in them a taste for the study of the heavens. We have said that Mr. Parkes is not always correct in his reproductions of astronomical facts, in illustration of which assertion we may quote his dictum on page 31, that it is "not determined whether the stars making up the galactic region are arranged in the form of a ring, with our sun and his planets in the centre," the fact being that it has been incontestably proved that by no possibility can such structure account for observed appearances. He is seemingly familiar with Herschel's first diagram, and knows nothing of what has been done since. Again, we should like to know when—and by whom—the supposition of the variability of Algol was found to be inconsistent with that of the revolution of a large dark planet round it, as stated on page 40. Further, he ought to be aware that the supposed determinations of the axial inclination of Venus to the plane of her orbit are worthless; and, moreover, that a dense atmosphere would keep in the heat like a blanket and not suffer it to radiate into space as he imagines on page 74. And yet again, what in the world does he mean by Mars coming into "*partial* opposition (!) . . . about every two years"? The synodical period of that planet either is, or is not, 779·82 days. He should read up the technical meaning of opposition in any standard work on astronomy. He might as sensibly talk of partial nothingness. Into his teleological argument it is wholly needless that we should follow him: though we may perhaps point out that on page 223, among other places, he muddles up Darwin's theory with Lamarck's. Has he ever opened "The Origin of Species"? Students of celestial physics will be curious to know how and when Dr. Huggins (with Dr. W. A. Miller at his elbow) ever had to ask Dr. Frankland and Mr. Lockyer to corroborate his observations; while astronomers will laugh outright to find the last-named gentleman's name quoted as that of an authority, in company with those of Sir William Thomson (not Thompson, as Mr. Parkes calls him), and Professors Young and Langley, on page 62.

Astronomical Revelations. (London: E. Dexter. 1887.)—It is difficult to enter into the feelings of a man who, knowing nothing whatever of his subject, sets himself calmly to dogmatise upon matters of scientific fact of whose true nature and bearings he is in the most profound ignorance, and who claims to teach that of which he has not himself the most distant glimmering. Of the supernal conceit of the anonymous author of the mass of rubbish whose title heads this notice some idea may be formed from the peroration of his first chapter, in which he has been asserting that the precession of the equinoxes is caused by the trade winds blowing the earth round!!! "And thus," he says, "more than two thousand years after the discovery of the phenomenon by Hipparchus, the true physical cause of the precession of the equinoctial points now, for the first time, stands revealed to the human intellect." Really the idea underlying this explanation (?) is delightful. The gentleman who lifted himself by the waistband of his own trowsers—to employ a current colloquialism—"wasn't in it" with our author. Pending his purchase, and study, of some shilling book on mechanics, we would suggest a simple experiment to him. It is to take a pair of bellows into a sailing boat, and see how fast he can drive her along by their aid. In Chapter II. the secular acceleration of the moon's mean motion is traced to "the earth's rotatory motion round the axis of the ecliptic." In Chapter III. we learn that the diminution of the obliquity of the ecliptic will continue until it and the plane of the equator coincide! Chapter IV. shows that there is no such a thing as aberration: in fact, that Bradley was a mere idiot. It is the deviation of the plumb-line that causes what we call aberration! But *finis coronat opus*, and, just as schoolboys save up a piece of crackling or fat for the last, so has our author reserved his choicest revelation for his concluding chapter. The Herschels—father and son—Mädler, Struve, Proctor, and others have fondly theorised on the constitution and structure of our stellar surroundings, on the assumption that the fixed stars are (practically) infinitely distant suns like our own. Not a bit of it! "The sun, which occupies the centre of our solar system, is the only visible self-luminous body at present existing in the celestial spaces." We are surrounded by a concave sphere of land and water, from the internal surface of which this sun is reflected hundreds and thousands of times (of course only from the water). But, as in the case of the earth, what is now land may in time become water, and *vice versâ*, so that when a fresh bit of the concave becomes watery enough to reflect our sun, a new star appears! We feel that an apology is due to our readers for wasting even the space we have done over such utter, irredeemable trash as this; but (always assuming that the writer of it is responsible for his actions) no denunciation can be too severe of any one of his intellectual calibre who presumes to teach that of which he knows less than nothing. His farrago of nonsense is beautifully printed and bound.

Seven the Sacred Number. By RICHARD SAMUELL. (London: Kegan Paul, Trench, & Co. 1887.)—Reflecting on the shortness of human life, there is something terribly saddening in the thought of the awful waste of time of which the author has been guilty in the compilation of the astonishing mass of puerilities which make up the volume before us. He suffers from what we may call septemania, in the most virulent form. Everything (he fancies)—or nearly everything—in the Bible is septenary in its arrangement or signification, or both; and when it is not, Mr. Samuell insists that it ought to be, and punctuates, redivides, alters, or otherwise juggles with the text in order to make it so. The amount of the most perverse ingenuity he exhibits in his exegetic ramblings is marvellous. He has, moreover, the most supernal contempt for Biblical critics who differ with him, and pooh-poohs poor creatures like Westcott and Hort without mercy when their interpretation of a passage clashes with his own heptadic tomfoolery. Leaving, however, his work in its more purely theological

aspect to the tender mercies of competent Hebrew scholars, let us turn for a few moments to his chapter on "The Number Seven in Nature." Now, to begin with, he here alleges that there are seven constituent colours in white light, which everyone possessing the merest smattering of science knows to be false. So, again, with our arbitrary arrangement of seven musical tones. But it is when our author arrives at our absolutely artificial systems of classification in the animal, vegetable, and mineral kingdoms that he shines the most. That they are purely conventional and invented to facilitate the study of the objects included in the various categories never seems to have occurred to him; and the way in which he gets seven out of Cuvier's classification is delightful. A page or two further on he is driven to separate the aquatic mammalia (as a class) from the terrestrial ones to eke out one of his "sevens," and, later still, to adopt a kind of table from Mr. Ralph Tate to show that there were seven geological epochs! He is very great, too, in chemistry, and it will, we think, rather astonish Professors Roscoe and Schorlemmer to see how ingeniously details in their classical book are twisted to fit Mr. Samuell's craze. We almost wonder that, in this connection, he did not give the seven bodies in alchemy. What we have said about zoological classification may be repeated, *mutatis mutandis*, with reference to our absolutely artificial arrangement of clouds; while, on cognate principles, he finds seven continents and seven oceans in the globe. The human body bothers him rather more, and here he flounders considerably in his efforts to show indications of some heptadic arrangement. Even the exploded delusion of phrenology has to be invoked to drag in thirty-five primitive faculties and seven rules! Then there are seven races of men, seven sciences (Heaven save the mark!), and we subsequently are treated to some of the arithmetical properties of the number seven. As our author obviously knows nothing whatever of the theory of numbers, he may be surprised to learn that the properties which so astonish him have their origin in our decimal system of notation, and would pertain to another number in, say, a duodecimal one. But we have already devoted very much more space than it deserves to a book which would be merely ridiculous but for the pity we must perforce feel for its author. Wrapped up in an overwhelming sense of his own almost superhuman wisdom and acumen, he is calmly thankful that to him has been revealed, in these latter days, that hidden meaning of the Bible, and, incidentally, of creation generally, which has hitherto been concealed from the best and wisest of mankind. To any one who cares to peruse a perfect example of what we have previously spoken of as the most absolutely perverse literary ingenuity we commend the study of "Seven the Sacred Number." But he ought to be a good-tempered man, of large and charitable views, or he may finish by speaking very disrespectfully indeed even of the author's common sense.

A Treatise on Geometrical Optics. By R. S. Heath, M.A. D.Sc. (Cambridge University Press. 1887.)—Dr. Heath's volume may be described, with but scant exaggeration indeed, as the very model of what a work on geometrical optics should be. He has availed himself of the researches of Abbé, Gauss, Helmholtz, Listing, and Maxwell, to say nothing of those of Cayley, Lloyd, Rayleigh, and Tait, with the result that he has succeeded in producing a text-book of great excellence. In the case of Gauss's theory of lenses, Dr. Heath works it out by elementary geometrical methods in accordance with the general plan of his work; but subsequently supplements this by Gauss's own beautiful analysis; which we a little fear will have to be skipped by many who will otherwise make good use of the book. The examples appended to each chapter seem remarkably well chosen. The chapters on recent improvements in the microscope, and on meteorological optics, contain much that is at once novel and interesting.

Philip's Planisphere, showing the principal Fixed Stars visible for every Hour in the Year from Lat. 35° South. (London: G. Philip & Son.)—This planisphere is identical in form with that of the Northern Sky, issued by the same publishers, of which we were enabled to speak so favourably on page 21 of our tenth volume, and will be found correspondingly useful by dwellers in South Australia, New Zealand, South Africa, and part of South America.

Elementary Chemistry. By M. M. Pattison Muir, M.A., and Charles Slater, M.A., M.B. *Practical Chemistry.* By M. M. Pattison Muir, M.A., and Douglas Carnegie, B.A. (London: C. J. Clay & Sons; Cambridge: Deighton, Bell, & Co.)—Conscientiously written and brought carefully up to the present stage of our knowledge, the two volumes whose titles head this notice form an admirable and thoroughly trustworthy introduction to the study of chemistry; and the beginner who will read them attentively through and perform the experiments described in the second of them with his own hands will have acquired a sound knowledge of the fundamental principles of the science, and laid a solid foundation for future study. The experiments seem particularly well chosen. We have, of course, made no attempt to check the figures which abound in the book, but, opening "Practical Chemistry" almost at random at page 206, we find the logarithm of 0·3937 given as 9·5951742; the real log. of 0·3937 being 9 (or, strictly, 1) ·5951654.

Moffatt's Deductions from Euclid. (London: Moffatt & Paige.)—These are series of riders, corollaries, &c., to the familiar propositions of the first six books of Euclid, some of them original and others derived from various sources. Their great use lies in the means they afford the student of finding out how far he has understood the various problems and theorems which they illustrate, and for this purpose they seem remarkably well adapted.

An Elementary Treatise on Light and Heat. By Rev. F. Wilkins Aveling, M.A., B.Sc. (London: Relfe Brothers.)—*Elementary Chemistry.* By J. C. Buckmaster. Revised and Corrected by C. A. Buckmaster, M.A., F.C.S. (London: Moffatt & Paige.)—*A Pupil Teacher's Handbook of Algebra.* By Rev. A. D. Capel, M.A. (London: Joseph Hughes. 1887.)—Innumerable additions have been made to our text-books of science since the craze for examination set in, and "the cry is still, They come." Many of the more recent ones have been really too good for merely cramming purposes, and Mr. Aveling's work is among them. Both Mr. Buckmaster's and Mr. Capel's books too at least fulfil the purpose for which they were written.

A Treatise on the Integral Calculus. Part I. By Ralph A. Roberts, M.A. (Dublin: Hodges, Figgis, & Co. London: Longmans, Green, & Co. 1887.)—We have a solitary fault to find with Mr. Roberts's valuable addition to our mathematical text-books. It is this: that his own acquaintance with his subject is so intimate and profound that he occasionally loses sight of the fact that the student must, *ex necessitate*, approach its consideration from a different standpoint, or lower level altogether, than he does. But having said this, we have little but praise for his book. His explanation of elliptic integrals is remarkably good, and throughout the work the numerous and well-chosen examples leave nothing to be desired.

The Real History of the Rosicrucians. By Arthur Edward Waite. (London: George Redway. 1887.)—We would recommend Mr. Waite's very painstaking volume to all who may be desirous to get to the back of the

Rosicrucian mystery (or imposture). So much nonsense has been talked and written about this imaginary order that it is quite refreshing to find a writer competent and willing to reduce the legend to its true proportions, and show how and when it had its origin. In Mr. Waite's pages we are furnished with the means of estimating the rhapsodies of such writers as Fludd, Vaughan, and Heydon at their true value, and of realising the extent to which such deceivers were themselves deceived. We cannot quite agree with our author that "there is no traceable connection between Masonry and Rosicrucianism," because every mason will at once detect the extent to which the imaginary ceremonial of the supposititious sect was borrowed from masonic ritual. Mr. Waite is justifiably severe on the modern aping of the non-existent mediæval fraternity.

A Professor of Alchemy. By PERCY ROSS. (London: George Redway. 1887.)—In the volume before us, Mr. Ross has told the painful story of Denis Zachaire, an alchymist of the sixteenth century. His weary toil after the secret of the philosopher's stone, and supposed success; his marriage with a nun who had fled from the vice of a convent; her betrayal, by one of the French nobility, to the bloodthirsty scoundrels who, under the title of the Holy Inquisition, so admirably illustrated one phase of the "infallibility" of the Romish Church; her death by poison, and the subsequent murder of Zachaire himself by De Foncé, afford a vivid picture of those bad old times for whose return some perverted intellects yet sigh, happily in vain.

First Lessons in Science. By the Right Rev. J. W. COLENSO, D.D. (Bishop of Natal). (London: William Ridgway. 1887.)—Here is the most delightful and instructive introduction to astronomy for children that we have, so far, ever come across. It appears to have been written twenty-seven years ago, but for the purpose of introducing the young to a knowledge of the system of which our own world forms a member, and of the universe of suns by which it is surrounded, it is as valuable now as on the day in which it was penned. The old solar parallax was, of course, employed by Dr. Colenso, and the editor of this reissue of the bishop's work has left the resulting figures and quantities intact in it. This, however, can interfere but slightly, if at all, with the educational value of the book, which we heartily commend to all who are interested in the introduction of science into our elementary schools.

Studies in Machine Design. By C. F. ARCHER. Series I. and II. (London: Griffith, Farran, Okeden & Welsh.)—These clearly executed examples of mechanical drawing will be found useful alike to the apprentice in the drawing-room and to the fitter at the lathe or bench. The first series consists of six plates of elementary examples, showing how to draw such simple pieces of mechanism as bolts and nuts, pistons, cylinder covers, &c. The second is of a more advanced character, and deals with a launch engine as a whole and in detail. Any tolerably intelligent mechanic ought to be able to read a drawing from a study of Mr. Archer's examples.

The Decorator's Assistant. Second Edition, Revised. (London: Crosby Lockwood & Co. 1887.)—The anonymous compiler of this mass of receipts, &c., has done real service not only to the professional decorator, but to every household whatever. Any one who wishes to make his house beautiful, externally or internally, should purchase this remarkable shilling's-worth straightway. He will find all that he requires, and much more besides, between its two covers.

We regret that space is too limited to permit us to do other than call the attention of our readers to, and urge their support of, Messrs. Smith & Elder's monumental enterprise, the *Dictionary of National Biography*, of which Volume XII. lies before us. There is no slackening of zeal, but rather a quickening of endeavour, in the promise of a yet more rapid issue of a work which is a credit to private enterprise, and as complete as the skill and erudition of Mr. Leslie Stephen can make it. The present volume carries us to "Craigie."

Among the current journals and serials we single out for special notice the *Edinburgh Review*, which gives an admirable and instructive critique of Mr. Lecky's new volumes of his "History of the Eighteenth Century;" *Longman's Magazine*, with its striking and novel account of the "peculiar people" of Salonika, Jews by descent and belief, but outwardly followers of Mahomet; and the *Westminster Review*, with a brief but vivid sketch of Emerson, and an encouraging article on the "Progress of the Masses." As for *St. Nicholas*, it remains far and away the best magazine for boys and girls, but we think the British public is getting weary of the American presidents and generals who have for months monopolised the pages of the *Century Magazine*.

THE FACE OF THE SKY FOR DECEMBER.

By F.R.A.S.

SHROUDED in the mists which obscure the winter horizon, and destitute of spots for days and even weeks at a time, the sun has ceased for the present to be an object of interest to the observer. He attains his greatest south declination in the early morning of December 22, which is thus "the shortest day." The night sky will be found depicted on map xii. of "The Stars in their Seasons." Minima of Algol (same map) will occur at 11h. 35m. P.M. on the 8th, at 8h. 23m. P.M. on the 11th, at 5h. 12m. P.M. on the 14th, and at 10h. 6m. P.M. on the 31st, as also at other times less convenient for the amateur. Mercury is a morning star throughout December. He attains his greatest western elongation from the sun (20° 32′) on the 5th. He rises some two hours before the sun at the beginning of the month, but is travelling so rapidly southward that his detection towards the end of it is in the last degree doubtful. Venus is a morning star too, and is a most brilliant and conspicuous object in the south-east before sunrise. She is at her greatest elongation west of the sun (46° 17′) on December 2. In the telescope she presents the figure of the moon about the time of her last quarter. Mars and Jupiter are, for the observer's purpose, still invisible. Saturn, however, is now coming into view again, as he rises about eight o'clock in the evening at the beginning of the month, and before 6h. P.M. at the end of it. But little alteration is noticeable in his ring system. He will be found to the west and north of δ Cancri ("The Stars in their Seasons," map iii.) Uranus is invisible; but Neptune may be picked up in the locality indicated in this column last month. The moon enters her last quarter at 3h. 10·8m. in the early morning of the 8th, and is new at 7h. 21·5m. in the evening of the 14th. She enters her first quarter at 7h. 1·2m. A.M. on the 22nd, and is full on the morning of the 30th at 8h. 14·3m. Four occultations only of fixed stars by the moon will occur during December at convenient hours for the amateur observer. On the evening of the 1st she will have occulted 119 Tauri, of the 5½th, and 120 Tauri, of the 6th, magnitude, before she rises; but the reappearance of the first-named star at her dark limb may be seen at 5h. 18m. P.M., at an angle of 248° from her vertex; and that of the second at 5h. 46m. P.M., at an angle from her vertex of 272°. Next, on the 18th, ε Capricorni, a star of the 4½th magnitude, will disappear at her dark limb at 5h. 58m. P.M., at an angle from her vertex, of 103°, reappearing at her bright limb 6h. 59m. P.M., at a vertical angle of 350°. Finally, on the 27th, 75 Tauri, a 6th magnitude star, will disappear at the dark limb of the moon at 6h. 26m. P.M., at an angle of 55° from her vertex, and will reappear at her bright limb at 7h. 35m. P.M., at an angle from her vertex of 274°. When these notes open the moon is in Taurus ("The Seasons Pictured," plate xxiii.), through which she is travelling until 2h. 30m. A.M. on the 2nd, at which hour she arrives at the western boundary of the northerly prolongation of Orion. When, by 2 o'clock the same afternoon, she has crossed this, she emerges in Gemini ("The Seasons Pictured," plate xxiv.). Her journey through Gemini occupies her until

10h. A.M. on the 4th, when she enters Cancer. She remains in Cancer until 11h. 30m. P.M. on the 5th, and then passes into Leo. She does not leave Leo for Virgo ("The Seasons Pictured," plate xxv.) until 2 P.M. on the 8th. She is in Virgo until 1h. P.M. on the 11th, and then crosses the boundary into Libra ("The Seasons Pictured," plate xxvi.). As she traverses Libra she, at 6h. 30m. A.M. on the 13th, reaches the western edge of the narrow northern spike of Scorpio, her passage across which she completes by 3 o'clock the same afternoon and comes out into Ophiuchus. She remains in Ophiuchus until 4h. A.M. on the 15th at which hour she quits it for Sagittarius. She is travelling through Sagittarius until 10h. A.M. on the 17th, when she enters Capricornus ("The Seasons Pictured," plate xxi.) She passes from Capricornus into Aquarius at 10h. A.M. on the 19th, and at 5h. P.M. on the 21st leaves the last-named constellation and enters Pisces ("The Seasons Pictured," plate xxii.). As she traverses Pisces she touches the boundary between it and Cetus, and passes into the last-named constellation at 11h. A.M. on the 22nd. At 6 P.M. on the 23rd she emerges into Pisces, only, however, to re-enter Cetus at 5h. P.M. on the 24th. When she finally leaves Cetus, at 7h. A.M. on the 25th, it is to pass into Aries ("The Seasons Pictured," plate xxiii.). 30 minutes after noon on the 26th she quits Aries for Taurus. Travelling, as at the beginning of the month, through Taurus, she reaches the western edge of the northernmost part of Orion, at 9h. 30m. A.M., on the 29th. She takes until 9 o'clock the same evening to traverse this, and then, as before, emerges in Gemini ("The Seasons Pictured," plate xxiv.). She is crossing Gemini until 4 P.M. on the 31st, at which hour she enters Cancer. She is, of course, in Cancer when our notes terminate.

Our Whist Column.

By "Five of Clubs."

MATHEWS ON WHIST.

Ruffing and Forcing.

NEVER ruff an uncertain card if strong in trumps, or omit doing so if weak. The last rule is one of the few universal maxims in whist, and cannot be too rigidly adhered to. It is right even when you know the best card of the suit is in your partner's hand. It has the double advantage of making a useless trump and telling your partner the state of your hand, so that he will play accordingly.

[Ruffing has this further advantage, that if your partner has the best card guarded, he remains with command over the suit—presumably the adversary's: this may be a decisive advantage later on. I suppose Mathews would scarcely insist on the ruff if partner is known to have the best card single. There are cases, however, where even in this position it is best to ruff. The trump card may be absolutely useless, and so nothing be lost, while it may be of critical importance to let partner know your weakness. Usually, however, in such a case the proper course would be to discard from a suit in which you may have a chance of getting a ruff more profitably. The former part of the above rule is by no means so constant a maxim as the latter. Thus with six trumps it is usually well to ruff an uncertain card and go on with trumps. Even with five trumps it is often well to ruff, not following, however, with a trump lead. There are positions, though they are seen but seldom, when it is well to ruff from strength though your partner holds the winning card (guarded), merely that he may be left with command of the enemy's suit. Still, as a general rule, with strength in trumps, a doubtful card should not be ruffed. In the next paragraph (not the next, in his book, however, by any means) Mathews discusses this matter keenly and justly, being especially careful to consider cases where the general rules, on which he properly insists, must be set aside.]

With a strong hand in trumps, particularly if you have a long suit, avoid ruffing your right-hand adversary as much as possible. As this is a maxim less understood, less followed, and more indispensably necessary than almost any other, I will endeavour to explain it to beginners as clearly as I can.

If cards are nearly equal, the point to which the manœuvres of all good whist-players tend is, on the one hand, to establish a long suit, preserving the last trump to bring that suit into play; and, on the other hand, to frustrate the same play of the adversaries. With an honour, or even a ten, and three other trumps, you have a right—if only you manage your trumps well—to expect success. In this case, if your right-hand adversary trumps a suit of which you are void, do not over-trump, but throw away a losing card; by this, since only twelve trumps remain, your own hand is strengthened, while whatever suit is led your partner has the tenace;* whereas, had you over-ruffed you would have given up the whole game to secure one trick. [For you remain with only three small trumps out of eleven left, and the tenace in your long suit remains with the enemy.]

There are cases, however, in which you break through this rule, viz.:—

First, if your left-hand adversary has shown a decided great hand in trumps—in which case make your tricks while you can.

Secondly, if your partner evidently meant to force you. To understand whether this is the case or not, note whether your partner played the winning card or a losing card of the suit of which you are void: if he played the winning card, it is by no means clear he meant to force you, and you should play your own game. If he played a losing card [knowing you to be void in the suit], you are to suppose him [if he understands the game] to be strong in trumps, and may depend on that strength of his to protect your long suit.

Due reflection on the case last considered will show you the value of the maxim which enjoins that you should never play a strong game with a weak hand, or *vice versâ*. [Mathews means that reflection on the inferences you draw from your partner's lead, in the case considered, shows you the importance of always suggesting correct inferences yourself, when in a similar case you have to lead; and thus Mathews enforces the general rule that your leads should always be such as to convey correct ideas as to your strength or weakness.] A few deviations from this effectually destroy the confidence which is necessary between partners: a confusion results which cannot but have the most disastrous consequences. Inattention to this rule cannot be too carefully avoided or too strenuously deprecated.

If strong in trumps, with the commanding card of the adversaries' suit and small ones, force your partner, if he has none of that suit, with the small ones, reserving the commanding card to the last.

It is a general maxim not to force your partner, unless strong in trumps yourself. There are, however, many exceptions to this rule, as—

First. If your partner has led from a single card. [In this case you force him to make the best of a bad business.]

Secondly. If the ruff saves or wins a particular point.

Thirdly. If great strength in trumps is declared against you.

Fourthly. If you have the chance of a "saw."

Fifthly. If your partner has been forced and did not follow with a trump lead.

Sixthly. It is often right in playing for the odd trick.

As regards forcing the enemy,—

Always force the strong, seldom the weak, never both adversaries. In this third case, you play your adversaries' game, and give the one an opportunity to make his small trumps while the other throws away his losing cards. Careless forcing is a very general as well as fatal error; the extent of the mischief is seldom comprehended by unskilful players, who, seeing the good effect of judicious forces, practise them indiscriminately, to their almost constant disadvantage.

The following case, showing the effect of a force, is too obvious not to be instantly comprehended: but the student should note that the same principle operates through the fifty-two cards, however various their combinations; and that its steady consideration [or rather its thorough mastery] is one of the most necessary steps towards an insight into the game:—

A has a seizieme major in trumps, a quart major in one plain suit, and a tierce major in another suit; and his adversary (either on the right or left) has six small trumps and the entire command of the fourth suit. In this case, one force on A gives B the odd trick: without such a force B loses every trick. Though so great an effect may seldom be produced, still there is scarcely a rubber where the truth of the general principle involved is not experimentally proved.

It is easy soon to discover the different strengths of [hands held by] good players, but more difficult with bad ones. When an adversary refuses to trump, and throws away a small card, you conclude [if he is a good player] that his hand consists of a strong suit in trumps, with one strong and another weaker suit. If he discards an honour, you know he has two suits only, one of which is trumps; in this case win tricks when you can. Avoid leading trumps when an adversary has thus declared trump strength, or to his plain suit force him, and give your partner an opportunity to trump if

* Mathews uses the word "tenace" in its proper sense, as signifying "the advantage" of position. There is no connection whatever, as many mistakenly imagine, between the cards ten and ace and the tenace. The word is French, and indicates the "hold" which a player has in particular positions.

possible. This line of play cannot be too maturely considered. A fault constantly committed by bad players, and among those most fatal in their consequences, is to lead trumps in defiance of commonsense, the moment an adversary refuses to ruff—though a winning card; they thus not unfrequently give away five or six tricks, which a judicious force would have saved.

Do not ruff a thirteenth card second hand if strong: but always if weak in trumps. If strong in trumps do not ruff the second best of any suit your partner leads, but throw away a losing card unless you have an established saw.

(*To be continued.*)

A correspondent sends the following whist problem:—

THE HANDS.

B { C. (*trumps*).—A, K, Q, 3. S.—A, Q. / D.—A, Q, 7, 6, 4, 3. H.—2. }

Y { C. (*tps*).—Kn, 10, 9. / D.—K, 9. / S.—9, 8, 7, 5, 4, 2. / H.—8, 4. }

B / Y Z / *Tr.* Clubs / A leads.

Z { C. (*tps*).—8, 6, 5. / D.—Kn, 10, 8. / S.—K, 6. / H.—10, 9, 7, 6, 5. }

A { C. (*trumps*).—7, 4, 2. S.—Kn, 10, 3. / D.—5, 2. H.—A, K, Q, Kn, 3. }

Clubs trumps—A to play and win all the (thirteen) tricks.

In all such problems, where one hand of the losing side seems to hold every suit guarded, as Z does here, the method of attack must be by forcing discards. I have not time to play out the hands (being, at the moment, very busily engaged on a lecture tour, with much literary work on hand), but I have no doubt the following line, if played, will win. A leads spades, B wins the trick and leads out his four trumps, then, according to Z's discard, B and A win the remaining tricks between them. Observe, that if Z's discard be the spade king, then A must presently discard the spade queen, so that B may make two spade tricks. If Z discards either heart or diamond, the rest of the solution is simplicity itself.

Our Chess Column.

By "Mephisto."

MATCH, BLACKBURNE *v.* GUNSBERG.

GAME V.—(King's Gambit Declined.)

White. Gunsberg.	Black. Blackburne.	White. Gunsberg.	Black. Blackburne.
1. P to K4	P to K4	23. Kt to Kt3	R × RP
2. P to KB4	B to B4	24. R × R	Q × P (ch)
3. Kt to QB3	P to Q3	25. K to K2 (*i*)	Q - R
4. Kt to B3	Kt to KB3	26. Kt to R5	Q to Bsq
5. B to B4	Kt to B3	27. Kt × R (*j*) (1h. 43m.)	Q × Kt (1h. 21m.)
6. P to Q3	P to QR3 (*a*)		
7. P to B5	Kt to QR4	28. Q × Q	K × Q
8. P to QR3 (*b*)	Kt × B	29. P × P	P - P
9. P × Kt (21m.)	Q to K2 (33m.)	30. Kt to Q2	P to Kt5
		31. R to QKt3	B to R3 (ch)
10. B to Kt5	P to QB3	32. K to B3	B to K2
11. R to KBsq (*c*)	P to QKt4	33. R to Ktsq	B to B5 (*k*)
12. P × P	RP × P	34. Kt × B	P × Kt
13. P to QKt4 (*d*)	B to Kt3	35. P to B3 (*l*)	P × P
14. Q to Q3	Castles (*e*)	36. R to QBsq (1h. 54m.)	B to Kt5 (1h. 34m.)
15. P to KKt4	B to Qsq		
16. KR to Ktsq	Q to B2	37. P to R4 (*m*)	P to R4
17. B × Kt	P × B (*f*)	38. P to Kt5	B to K2
18. Q to Q2 (53m.)	K to Rsq (58m.)	39. R × P	P - P
		40. P × P	B × P
19. Q to R6	KR to Ktsq	41. R × P	B to B5
20. R to Kt3	Q to K2 (1h.)	42. R to B7	K to B3
		43. R to Kt7 (2h. 5m.)	K × P (1h. 55m.)
21. R to R3	R to Kt2	Drawn game.	
22. Kt to K2 (*g*) (1h.)	P to Q4 (*h*) (1h. 18m.)		

Notes.

(*a*) This is done to prevent the exchange of B for Kt and the threatening of B to K Kt5.

(*b*) The object of this move, which we imagine comes too late, is to prevent B to Kt5 after Kt × B.

(*c*) To provide against P to K Kt3.

(*d*) Necessary to prevent the break-up of the position by P to Kt5.

(*e*) Premature; B to Q2, because of his subsequent troubles, would have been much better.

(*f*) P × P is a blunder, which ought to have lost the game. B × P is much superior.

(*g*) With the object of reaching R5.

(*h*) Black evidently calculated upon sacrificing QR, but, as will be seen afterwards, this desperate remedy should be of no avail against best play. If Black had continued Q to Bsq the game might have proceeded—23. Kt to Kt3, Q to Ktsq; 24. P to Kt5, P × P; 25. Kt to R5, P to Kt5; 26. R to Kt3, &c.

(*i*) White here misses the win; Kt to Q2 was the winning move, for Black could not play Q × R on account of White's reply Q × Rch, K × R, Kt to R5 ch regaining Q with a rook ahead.

(*j*) Although from the appearance of the position it would seem at first glance that White could have done better, yet on closer examination it will be found that any other line of play would not have been favourable for White. If, for example, White played 27. P to Kt5, P × KP, and White cannot play 28. P × BP on account of R to Kt7ch.

(*k*) P to R4 would have been stronger.

(*l*) This move ensures the draw.

(*m*) White's object, having sacrificed the pawn, is to gain both pawns on QB file by playing up his King, but he seeks to provide against P to R4 first.

GAME VII.—(Falkbeer Countre Gambit.)

White. Gunsberg.	Black. Blackburne.	White Gunsberg.	Black. Blackburne.
1. P to K4	Pt to K4	22. QR to R4 (52m.)	P to QR3 (1h. 5m.)
2. P to KB4	P to Q4	23. Kt × P (53m.)	B × Kt (1h. 12m.)
3. P - P	P to K5 (*a*)		
4. B to Kt5 (ch) (3m.)	P to B3 (1m.)	24. R × B (53m.)	K to B2 (1h. 12m.)
5. P - P (4m.)	Kt × P (*b*) (3m.)	25. P to KKt3 (57m.)	R to QKtsq (1h. 14m.)
6. P to Q4 (5m.)	Q to R4 (ch) (*c*) (4m.)	26. KR to R2 (59m.)	QR to Kt2 (1h. 14m.)
7. Kt to B3 (5m.)	B to QKt5 (5m.)	27. R × P (1h. 1m.)	Kt to K2 (1h. 15m.)
8. B to Q2 (*d*) (8m.)	Kt to B3 (15m.)	28. QR to R6 (1h. 1m.)	R × P (ch) (1h. 15m.)
9. B × Kt (ch) (15m.)	P × B (15m.)	29. R × R (1h. 3m.)	R × R (ch) (1h. 15m.)
10. P to QR3 (15m.)	P to K6 (*e*) (24m.)	30. K to Q3 (1h. 3m.)	Kt to Bsq (1h. 16m.)
11. P × B (21m.)	P × B (ch) (24m.)	31. P to B5 (1h. 4m.)	Kt to K2 (1h. 16m.)
12. K - P (22m.)	Q × P (26m.)	32. R to Q6 (1h. 6m.)	Kt to Bsq (1h. 21m.)
13. Q to K2 ch (*f*) (29m.)	K to Bsq (*g*) (42m.)	33. R to Q8 (1h. 7m.)	Kt to K2 (1h. 22m.)
14. Q to K5 (38m.)	Kt to Kt5 (*h*) (45m.)	34. P to Q5 (1h. 1m.)	R to Kt4 (1h. 25m.)
15. R to R4 (*i*) (38m.)	Kt × Q (*j*) (55m.)	35. K to B4 (1h. 8m.)	R to Kt7 (1h. 25m.)
16. R - Q (*k*) (38m.)	Kt to Kt3 (57m.)	36. Kt to B3 (1h. 8m.)	R × P (1h. 27m.)
17. KKt to K2 (40m.)	P to KB4 (58m.)	37. P to B6 (1h. 8m.)	P to Kt4 (1h. 35m.)
18. Kt to R4 (42m.)	B to B3 (59m.)	38. P to B7 (1h. 9m.)	P × P (1h. 35m.)
19. P to B4 (45m.)	R to K-q (1h.)	39. P - P (1h. 10m.)	R to KKt7 (1h. 40m.)
20. Kt to B5 (45m.)	B to Bsq (1h.)	40. P to Q6 (1h. 10m.)	Resigns.
21. R to Rsq (46m.)	R to K2 (1h. 1m.)		

Notes.

(*a*) An unsound defence; P × P is preferable.

(*b*) P - P is the usual move.

(*c*) This and the following moves assist White in the development of his game; Black ought rather to have played Kt to B3.

(*d*) Best.

(*e*) This move promises a strong attack; as the sequel shows, it is of no avail.

(*f*) Much superior to K to Bsq.

(*g*) Difficult to choose. B to K3 loses the B, although Black would have gained a strong attack; if K to Qsq.; White plays as in the text; if Q to K2, then R to Ksq.

(*h*) A tempting move. There was nothing else.

(*i*) The correct answer; of course Black cannot take R.

(*j*) Q to Kt2 was slightly better, for if Q to K6 (ch), Q inter-

poses—Q × Q, K × Q, which is the most favourable continuation Black can hope for; he will now be able to bring his KR into play.

(*k*) There is now scarcely any chance for Black.

GAME X.—(QUEEN'S BISHOP'S OPENING.)

	WHITE. Blackburne.	BLACK. Gunsberg.		WHITE. Blackburne.	BLACK. Gunsberg.
1.	P to Q4	P to Q4	41.	Kt to B5 (2h. 17m.)	P to B6 (1h. 55m.)
2.	B to B4	Kt to KB3	42.	P to Kt5 (2h. 22m.)	B × P (1h. 56m.)
3.	P to K3 (1m.)	P to B4 (4m.)	43.	Kt to Q6 (2h. 24m.)	Q to Q2 (1h. 56m.)
4.	Kt to KB3 (5m.)	P to K3 (6m.)	44.	Kt - B (2h. 25m.)	Q - Kt (1h. 56m.)
5.	P to B3 (*a*) (7m.)	P to QR3 (9m.)	45.	R × P (2h. 25m.)	Q to B5 (*n*) (2h. 16m.)
6.	B to Q3 (10m.)	P to B5 (9m.)	46.	R to KB2 (2h. 36m.)	B to K2 (2h. 20m.)
7.	B to B2 (10m.)	P to QKt4 (10m.)	47.	R to B7 (*o*) (2h. 44m.)	B to Q3 (2h. 25m.)
8.	Castles (11m.)	B to Kt2 (10m.)	48.	R to R6 (2h. 45m.)	K to B3 (2h. 27m.)
9.	QKt to Q2 (14m.)	QKt to Q2 (11m.)	49.	QR to B6 (2h. 51m.)	Q to B1 (2h. 27m.)
10.	R to Ksq (18m.)	Kt to R4 (12m.)	50.	K to R2 (2h. 54m.)	K to Q2 (*p*) (2h. 34m.)
11.	B to KKt3 (*b*) (25m.)	Kt - B (12m.)	51.	R to R7 (ch) (2h. 54m.)	K to Ksq (2h. 36m.)
12.	RP × Kt (25m.)	P to B4 (*c*) (13m.)	52.	R to K6 (ch) (2h. 55m.)	B to K2 (2h. 39m.)
13.	Kt to Bsq (*d*) (31m.)	P to KR4 (*e*) (19m.)	53.	R to QR6 (2h. 55m.)	K to Q2 (2h. 42m.)
14.	QKt to R2 (34m.)	B to Q3 (20m.)	54.	R to Rsq (2h. 58m.)	P to B7 (2h. 45m.)
15.	K to Bsq (38m.)	P to Kt4 (21m.)	55.	R to Bsq (3h.)	Q to B6 (2h. 45m.)
16.	K to K2 (38m.)	P to KKt5 (24m.)	56.	R to R5 (3h. 10m.)	K to K3 (2h. 48m.)
17.	Kt to R4 (*f*) (41m.)	Q to Kt4 (29m.)	57.	R to R6 (ch) (3h. 12m.)	B to B3 (2h. 15m.)
18.	R to Rsq. (45m.)	P to R4 (30m.)	58.	Kt to Q2 (3h. 18m.)	Q × Kt (2h. 49m.)
19.	P to R3 (50m.)	B to R3 (35m.)	59.	R to KBsq (3h. 18m.)	Q to B6 (2h. 49m.)
20.	Kt to Bsq (1h. 5m.)	K to Qsq (39m.)	60.	R to Kt6 (3h. 20m.)	P to B8 (Queens) (*q*) (2h. 19m.)
21.	Kt to Q2 (*g*) (1h. 6m.)	K to B2 (39m.)	61.	QR × B (ch) (3h. 21m.)	Q - R (2h. 52m.)
22.	K to Bsq (1h. 9m.)	Kt to B3 (52m.)	62.	R × Q (ch) (3h. 21m.)	K to Q2 (2h. 52m.)
23.	Q to K2 (1h. 20m.)	Kt to K5 (56m.)	63.	R to Q6 (ch) (3h. 27m.)	K to B2 (2h. 53m.)
24.	B × Kt (1h. 24m.)	BP × B (56m.)	64.	R to Q7 (ch) (3h. 32m.)	K to Kt3 (2h. 53m.)
25.	K to Ktsq (1h. 25m.)	KR to KBsq (57m.)	65.	R × P (*r*) (3h. 35m.)	Q × P (2h. 53m.)
26.	QR to KBsq (1h. 26m.)	R to B3 (59m.)	66.	R to Qsq (3h. 38m.)	Q to B4 (2h. 54m.)
27.	Q to Qsq (1h. 33m.)	QR to KBsq (1h.)	67.	R to Ksq (3h. 45m.)	Q to R4 (ch) (2h. 55m.)
28.	Q to K2 (1h. 36m.)	P to K4 (*h*) (1h. 10m.)	68.	K to Ktsq (3h. 40m.)	Q to KB4 (2h. 56m.)
29.	Q to Ksq (1h. 44m.)	R to K3 (*i*) (1h. 17m.)	69.	K to R2 (3h. 45m.)	K to B4 (2h. 56m.)
30.	P × P (1h. 53m.)	B × P (1h. 19m.)	70.	R to Qsq (3h. 46m.)	K to B5 (2h. 57m.)
31.	Q to K2 (1h. 54m.)	Q to K2 (1h. 24m.)	71.	K to Ktsq (3h. 49m.)	P to K6 (2h. 59m.)
32.	R to Qsq. (1h. 56m.)	KR to B3 (1h. 26m.)	72.	K to R2 (3h. 50m.)	P to K7 (2h. 59m.)
33.	Kt to Bsq (*j*) (1h. 57m.)	P to Kt5 (*k*) (1h. 30m.)	73.	R to QRsq (3h. 57m.)	K to Q6 (3h.)
34.	RP × P (1h. 58m.)	P × P (1h. 31m.)	74.	R to QBsq (3h. 58m.)	K to Q7 (3h.)
35.	P - P (1h. 58m.)	R × P (*l*) (1h. 58m.)	75.	R to QRsq (3h. 58m.)	Q to R4 (ch) (3h.)
36.	Q × R (1h. 59m.)	R × Q (1h. 35m.)	76.	K Ktsq (3h. 58m.)	P Queens (ch) (3h.)
37.	K × R (1h. 59m.)	Q to B2ch (*m*) (1h. 40m.)	77.	R × Q (3h. 58m.)	Q to B4 (eh) (3h.)
38.	K to Ktsq (2h.)	B × QKtP (1h. 40m.)		Resigns.	
39.	R to Q2 (2h. 5m.)	B to B3 (1h. 46m.)			
40.	R to QR2 (2h. 10m.)	K to Kt3 (1h. 52m.)			

NOTES.

(*a*) Rather slow for the first player.

(*b*) This is not the best; Kt to K5, or B to Kt5 is preferable.

(*c*) To prevent the advance of KP.

(*d*) White in this and the next few moves wastes valuable time.

(*e*) Initiating the attack.

(*f*) This blocks up the knight, but if any other move P to R5 follows.

(*g*) P to B4 was the right move here.

(*h*) The object being to get the KB in a good position, defend the QB, and thus prepare for the advance of QKtP.

(*i*) Threatening P × P, and P to K6.

(*j*) If White played R to KBsq, Black gets a winning advantage by P to Kt5.

(*k*) Better than R × P.

(*l*) Black has attained his object of weakening the White pawns, and may now safely exchange rooks for Queen.

(*m*) Q to B3 (ch) was perhaps preferable.

(*n*) It was very difficult to decide which was the proper move, as White's intention obviously is to bring both rooks into play.

(*o*) If P to B7, followed by P queens, the win is not by any means clearly evident.

(*p*) The ending was exceedingly difficult, as Black was afraid of a draw by stalemate, but he could have played P to B7 instead. White then answers Kt to Q2, P queens, Kt × P, Q(B4) × P, and Black would win.

(*q*) Pr mature; K to B2 was better, as it would have avoided the stalemate position.

(*r*) If R to Q6 (ch), Q interposes; and if R to Kt7 (ch), K to R4, and ultimately reaches R7, and wins.

The *Evening Star* (Dunedin, New Zealand), of September 7, 1887, states that there can be no doubt that Professor LOISETTE'S System of Memory-Training is of great practical utility, and refers to information a Dunedin Student has acquired by the aid of the System in these words:—"Mr. W. B. Eyre has demonstrated to our satisfaction that he can answer any questions correctly on the following subjects—The Kings and Queens of England; the Kings and Presidents of France; the Presidents of America; the names of Shakespeare's plays and the characters in the principal tragedies; the specific gravities of metals; the logarithms of numbers up to 100; when ancient philosophers and modern celebrities flourished; the dates of various inventions; the winners of the English Derby and the Melbourne, Sydney, and Dunedin Cups; the averages made in batting and bowling by the Australian cricketers in England and the English team in Australia; the results of the Otago and Canterbury cricket matches and the Oxford and Cambridge boat-races; the heights of the notable mountains of the world and all New Zealand ones, as well as of monuments and spires; the average height of European soldiers; and the length of the longest rivers in the world, &c. By the aid of the system Mr. Eyre can also repeat backward as well as forward any list of figures which may be read to him, and he also assures us that he recollects poetry and prose with much greater ease than formerly. It is not improbable that he will give a public exhibition of his powers."

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THE STREAM OF LIFE.

(Concluded from page 3.)

IN the carboniferous strata, which in some places attain a thickness of nearly four miles, we find evidence of an amazing wealth of vegetation—uniform in general character, for as yet the earth seems to have had no seasons so far as heat was concerned—but very varied in details. The most characteristic peculiarity of animal life was the prevalence of amphibia, represented chiefly by immense creatures resembling the modern salamander, but attaining a length of seven or eight feet. Enormous sharks swept through the seas of the time, armed with teeth capable of crushing the strong incasing armour of the ganoid fishes which probably formed their prey. As the Permian era came on, the Flora and Fauna changed by slow processes of development, both still retaining, however (over the whole earth, so far as can be judged), their tropical character.

We find so marked a contrast in passing from the Permian system to the Triassic—that is, from the highest of the primary to the lowest of the secondary strata—that had not experience taught us to recognise in such marked change merely evidence that many leaves are missing from the geological record, we might be tempted to believe, with the geologists of former times, that the primary forms of life had been for the most part replaced by new creatures. In our time, however, all we infer from the great change in many forms of animal and vegetable life is that immense periods of time passed after the last of the Permian strata were deposited before the first of the Triassic rocks began to be formed. The records of these vast time intervals have been destroyed by denudation.

Some, however, of the old genera of plant life and of animal life still remained. Conifers, which had existed in the previous era, were now more numerous and in greater variety. But Cycads were the predominating form of vegetable life throughout the Mesozoic period, which has been called, on this account, the "Age of Cycads." Amphibians now increased in numbers, while lizards made their first appearance (so far, at least, as the geological record attests). Deinosaurs, which may be regarded as a connecting link between birds and reptiles, appeared and disappeared during the Mesozoic era—becoming extinct, like other transitional types, within a comparatively short time, though the absolute duration of their existence on the earth may probably be measured by millions of years. The footprints of some of these creatures, which walked on their hind legs, were mistaken by the earlier geologists for the traces of gigantic birds; but although birds, and gigantic ones, appeared during the Mesozoic ages, the deinosaurs were not flying creatures. When we consider the enormous size of some of them, as the *brontosaur*, whose feet left imprints a square yard in area; the *stegosaur*, whose bony back-plates were 3 feet across; and the *atlantosaur*, the most massive of all known creatures, probably of all creatures which have ever existed (it seems to have been about 100 feet long and 30 feet high), we may regard the power of flying as not one which deinosaurs needed or were likely to possess.

In this age, also, the great sea saurians throve, multiplied and died out. The ichthyosaur, with eyes a foot in diameter; the long-necked plesiosaur, the pythonomorphic, or serpentine, saurians, of which no fewer than forty varieties have been recognised, some of them being more than 75 feet in length, were among the denizens of the sea in Mesozoic time.

This was the age also of those bat-winged reptiles, the Pterosaurs, some of which were of enormous size. But these again were probably transitional forms, and are now extinct. The birds of the Mesozoic ages, which show many reptilian characteristics, represent more successful lines of development; and though none of the birds known to belong to Mesozoic times remained in later ages, the birds even of our own time afford in their structure abundant evidence of their descent from those earlier birds, or from their contemporaries.

It was in the long-lasting Mesozoic or secondary ages, further, that mammals, afterwards to obtain dominion over the earth, first made their appearance, though the traces of them are but few and far between. Teeth of a small marsupial animal akin to the banded ant-eater of New South Wales are found as low as the Triassic strata (the lowest of the secondary formations), while in the Jurassic, or next higher system, other forms of insectivorous marsupials are found, along with one which Owen regarded as an herbivorous placental mammal and another which he regarded as probably carnivorous.

Geology has now long passed that stage of its progress when the tertiary, or Cainozoic, periods were supposed to be separated by a distinct line of demarcation from the secondary, or Mesozoic. The cretaceous system, or chalk, was found to be in many places succeeded by beds of pebble, sand and clay, of entirely different character from any of the chalk formations. In these upper beds no fossils could be found which had been recognised in the chalk. But researches, at once wider and more detailed, showed that parts of the leaves which seemed thus to be missing exist elsewhere. The break in the continuity of deposits in some places shows only that denudation had either completely removed the missing strata before the higher beds began to be deposited, or else in certain regions no strata were deposited.

Yet on the whole we find a marked change in the earth's aspect in Cainozoic times, as well as a characteristic difference in the manner in which the crust of the earth behaved. During the Tertiary period the continents of the earth were fashioned nearly into the forms they have in our own time. Processes of contraction affecting a crust which, owing to increased thickness and diminished plasticity, no longer yielded easily to the pressures and strains acting upon it, resulted in the formation of the great mountain ranges, by the upheaval (through side pressures) of the thick and deep strata formed during the primary and secondary periods upon the original crust. Parts of what was sea-bed at the beginning of Tertiary time are now found three miles above the sea level; and doubtless other portions were raised even higher, but have been carried down from the positions so reached, by the action of the denuding forces which have carved the peaks and pinnacles of mountain ranges, until in many parts the inner Archæan core has been exposed.

In the Tertiary strata we recognise first the signs of a diversity of temperature beginning to exist in different parts of the earth. Early in Tertiary time, indeed, even the

arctic regions had a mild climate, but towards the close of the long-lasting periods of the Tertiary age snow and ice had spread, not only over the whole of the arctic regions, but even over parts of the European and American continents which at present are free from them. This, however, must be regarded as indicating only a temporary extension of the northern snows and ice. Even during eras belonging to the close of Tertiary time the earth possessed on the whole a warmer and more equable climate in high latitudes than she has now.

The vegetation of the earth now began to resemble closely the vegetation of the present day. Nearly all the genera of later Tertiary vegetation still throve on the earth. Animal life began also to resemble the animal life of to-day much more closely than during preceding eras. Mammals not only made their appearance on the earth, but, as usual with successful incoming types, they showed at the outset of their career a richness and fulness of development such as they do not present in these times. The pachyderms, still the largest of the land mammals, were much larger in Tertiary times than now. In Tertiary ages, also, gigantic cetacean sea mammals, the ancestors of the whales, dolphins and kindred races of our own times, gradually took the place of the monstrous sea saurians of preceding ages.

The division of Tertiary time into Eocene, Miocene, and Pliocene periods indicates the recognition among geologists of the growth and development of modern forms of animal and vegetable life during the Cainozoic eras. For these names imply simply "Dawn of Recent," "Fewer Recent," and "More Recent," "forms of life" being understood. The lower Tertiary strata are called Eocene to show that recent forms of life begin to be recognised in those strata; in the Miocene strata recent forms of life are more numerous than they had been but still not so numerous as the ancient forms, while in Pliocene recent forms have not only increased in number but they now exceed the ancient forms, and in gradually increasing degree, till as we are passing from the upper Tertiary to the lower Quaternary or recent strata we have to change our descriptive term from Pliocene or more recent (than ancient) to Pleistocene, or mostly recent.

In considering the Flora of the Eocene period, we are chiefly struck by the evidence it affords of the extension of a climate still tropical over regions now temperate, and of a climate still warm over regions now intensely cold. Plants now only found in the hotter parts of Asia, Africa, America, and Australia throve then in Canada, Scandinavia, and Siberia. Ferns and evergreens were numerous, but many deciduous trees—elms, hazels, willows, planes, chestnuts, &c., —had now made their appearance. The Fauna of this period also indicates a generally tropical climate extending over the temperate zones, and a temperate climate extending to far within the arctic regions. Reptilian life was no longer so preponderant as during Mesozoic time, the reptiles still thriving in the Eocene period being chiefly turtles, tortoises, and crocodiles, closely resembling those now existing. Remains of birds are found more freely in Eocene strata than in the lower formations, though avian fossils are naturally not abundant in any strata, the power of flight saving birds from most of those forms of death which favoured the preservation of fossil remains. True mammals now made their appearance in great numbers. Small pony-like animals appeared—the ancestors probably of the horse, ass, zebra, and quagga, but differing from the modern equine races in possessing most of the toe of each foot, whereas the Equus of to-day possesses only the middle toe complete, the side toes being represented only by rudimentary splints. Hogs of various kinds, deer and antelopes, squirrels, lemurs and bats had now appeared. Races also now seen for the first time, but not destined to last to our own day, throve and multiplied during the Eocene period—creatures (the tinoceras and deinoceras) like the rhinoceros in structure, but having six horns instead of two, and like the elephant in size, were now the most powerful denizens of the forest.

Throughout the closing part of the Eocene period, called sometimes the "Oligocene" (or "Few-recent"), there was a general though slow progress towards the condition found during Miocene time, during which the Flora and Fauna showed a marked advance towards the characteristic forms of recent geological time. Still, however, even in the Miocene age, the forests which adorned temperate regions resembled rather those found in India and Brazil than the forests of middle Europe and other such regions now. Beeches, laurels, oaks, and poplars, as well as magnolias, myrtles, sumachs, mimosas, and acacias, were now abundant. Through the forests ranged giraffes, deer, antelopes, three-toed horses, wildcats, bears, sabre-toothed lions, monkeys, and apes. The deinotherium and mastodon were doubtless, however, the most powerful land animals; the deinotherium, as large as the elephant, with two immense tusks in the lower jaw, curved somewhat like those of the walrus; the mastodon, a form of elephant, but in some cases armed with four tusks, two in the lower as well as two large tusks in the upper jaw. The forms of insect life also were particularly rich, especially the wood beetles, which attained often singularly large dimensions. Frogs, toads, lizards, and snakes were also numerous in the Miocene period. Large cetaceans traversed the Miocene seas (their ear-bones are found in considerable numbers in the raised sea-beaches belonging to this part of Tertiary time).

In Pliocene times, as the name implies, modern forms of vegetable and animal life had become still more common. Tropical types of vegetation were no longer found in the higher temperate latitudes, and the forms gradually approximated more and more in character to those now occupying the corresponding regions. The Fauna also presented similar characteristics. Tribes of animals roamed over Europe in the earlier portions of the Pliocene period which are now found only on the southern side of the Mediterranean. In England, even in the latter part of Pliocene time, the hyena, rhinoceros, elephant, and other animals, now limited to tropical or sub-tropical regions, must have been numerous to account for the frequency of their remains.

No definite dividing line can be drawn between the Tertiary and Quaternary periods. The change from Eocene to Miocene, or from Miocene to Pliocene, corresponded closely in character with the change from Pliocene to Pleistocene. Ever since the time when life, vegetable or animal, had first appeared on the earth, multitudinous forms of life had come into existence, had risen into greater or less prominence according to their surroundings, and had in some cases died out, in others had developed succeeding races more or less closely akin to them, and in yet others had continued scarcely changed even throughout the millions of years which separate the beginnings of the Palæozoic periods from our own time.

The steady advance of the stream of life, with its various waves thus either dying out, or merging into other waves, or progressing scarcely changed age after age, had gradually led to the development of more and more of those forms of vegetable and animal life which we regard as belonging specially to the present age of our earth's history. For gradually the earth's surface had changed from a condition utterly unlike what now exists to nearer and nearer resemblance to its present aspect. At the beginning the internal heat had extended its influence over the whole surface of the earth, throughout the whole ocean,

even throughout the whole atmosphere; and the stream of life on the earth had corresponded in character to this uniformity of thermal condition. But as during millions of ages the internal heat gradually diminished, the earth began to recognise, as it were, more clearly age after age the influence of the central sun, one day to become supreme in determining the conditions of life. Throughout the later Palæozoic, the earlier and later Mesozoic, and even the earlier Cainozoic periods, the sun's influence was small in determining differences of condition between different parts of the earth. But from the middle of the Tertiary era onward to the beginning of the era which we recognise as recent—though in reality it has already lasted some 200,000 or 300,000 years—the influence of the sun has in this sense been paramount, that it has divided the earth into climates, corresponding generally though not exactly with zones limited by various latitudes; that is, with zones within which the sun's direct influence as measured by his midday height in different parts of the year has such and such definite range.

What we call the Quaternary period may be regarded as beginning with the time when the sun's influence thus became predominant; when the earth's surface became divided in respect to the forms of vegetable and animal life, as well as in the astronomical sense, into the tropical and sub-tropical zones, the temperate zones, and the arctic and antarctic regions. The range of the various climates which we may call tropical, temperate, and arctic, altered measurably, even markedly, from time to time. Sometimes the glacial regions invaded regions which had been temperate in climate, nay, had even presented semi-tropical forms of life; at others the ice masses retreated even within their present limits.

MOON LORE AND ECLIPSE SUPERSTITIONS.

BY "STELLA OCCIDENS."

IN the beginning, according to the Elder Edda, there were two worlds—Nifiheim, or the nebulous world, and Muspelheim, or the fire-world. Muspelheim was so hot that it burned and blazed. The heavenly bodies were made from its sparks, and these were placed in the heavens by the gods, to give light to the world.

> The sun knew not his proper sphere,
> The stars knew not their proper place,
> The moon knew not where her position was:
> There was nowhere grass until Bor's sons
> The expanse did raise, by whom the great Midgard was made.
> From the south the sun shone on the walls;
> Then did the earth green herbs produce.
> The moon went ahead, the sun followed,
> His right hand held the steeds of heaven.

Mundilfare was the father of the sun and moon, and they were placed in the heavens. The sun travels at a great rate, as if some one were pursuing her for her destruction. It was supposed that a wolf, called Skol, pursued the sun, and would one day overtake and devour her. In like manner a wolf called Hate—Hrodvitneson—runs before the sun, and pursues the moon, that will one day be caught by him. These two wolves are the sons of a giantess, who dwells in a wood called Jarnved, situated east of Midgard (the earth, and the abode of a race of witches). The most formidable of all these witches is one called Maanagarm (moon-swallower). He is filled with the life-blood of men who draw near to their end, and he will swallow up the moon, and stain the heavens and the earth with their blood:—

> The moon's devourer, in form most fiend like,
> And filled with the life-blood of the dead and the dying,
> Reddens with ruddy gore the seats of the High gods.
> Then shall the sunshine of summer be darkened,
> And fickle the weather! Conceive ye this or not?*

A Mongolian myth asserts that the gods determined to punish Arakho for his misdeeds; but he hid so well that no one could find his hiding-place. They therefore asked the sun, who gave an unsatisfactory answer; but when they asked the moon, she told where he was. So Arakho was dragged forth and chastised. In revenge he pursues the sun and moon, and, whenever he comes near enough, an eclipse occurs. To help the sun and moon in their sad plight a tremendous noise is made, till Arakho is scared away.

The Aleutians and the Icelanders apparently have the idea that the moon should be treated with great respect, otherwise she would punish them by throwing down stones. A story is told about an Icelander who stole a piece of cheese. Whilst he was eating it, he happened to notice the moon shining brightly overhead. He stuck a piece on the end of his knife and offered it to the moon. Another time a sheep-stealer, who was feasting on a leg of mutton he had stolen, observed the moon shining bright and clear. He also invited the moon to take part in the feast in the following words:—

> O moon, wilt thou
> On thy mouth now
> This dainty bit of mutton eat?

A voice from the heavens replied:—

> Wouldst thou, thief, like
> Thy cheek to strike
> This fair key, scorching red with heat?

A red-hot key fell from the sky, burning on the thief's cheek a mark which remained for ever afterwards. This was supposed to have originated the custom of branding thieves, though why a key should have been chosen in this case it is difficult to imagine.† In Scotland, Devonshire, and Cornwall, pointing at the moon is an insult to be carefully avoided, or the most dire results may follow.

At Whitby when the moon is surrounded by a halo of watery clouds, the seamen say that there will be a change of weather, for the moon-dogs are about. An amusing story is told about a fisherman in Torquay. A gale having taken place during the night, he said he had foreseen it, as he had noticed a star ahead of the moon towing her, and another astern chasing her—"I know'd 'twas coming safe enough."

In the Vedic hymns Rakha, the full moon, is supposed to make beautiful garments for night and morning, with a needle which can never be broken. She weaves together the roseate hues of morning, and the soft mellow tints of evening. The Danes have elves called "Moon Folk." The man of this race is like an old man with a low-crowned hat upon his head: the woman is very beautiful in front but behind she is hollow, like a dough-trough, and she has a sort of harp on which she plays and lures young men with it, and then kills them. The man is also an evil being, for if any one comes near him he opens his mouth and breathes upon the rash mortal, and his breath causes sickness. It is easy to see what this tradition means: it is the damp marsh wind laden with foul and dangerous odours; and the woman's harp is the wind playing across the marsh-

* "Norse Mythology," Anderson, pp. 176–179.
† Harley, "Moon Lore," p. 150.

rushes at nightfall.* In the "Midsummer Night's Dream" the fairy queen says to the king:—

> These are the forgeries of jealousy;
> And never, since the middle summer's spring,
> Met we on hill, in dale, forest, or mead,
> By paved fountain, or by rushy brook,
> Or in the beached margent of the sea,
> To dance our ringlets to the whistling wind;
> But with thy brawls thou hast disturbed our sport.
> No night is now with hymn or carol blest:
> Therefore the moon, the governess of floods,
> Pale in her anger, washes all the air,
> That rheumatic diseases do abound;
> And this same progeny of evil comes
> From our debate, from our dissension;
> We are their parents and original.

Among the Mexicans an eclipse of the moon is supposed to be the moon devoured by a dragon. The Hindoos have the same belief, and both nations continued to use the expression long after they had discovered the true cause of an eclipse.† Captain Beechman relates that one evening when he was at supper with some friends in the island of Borneo, they heard a great noise outside. "The natives were yelling, and clattering brass pans and gongs, and firing off guns. When we inquired the reason of their excitement, one of the natives pointed up to the heavens, and said, 'Look there; see, the devil is eating up the moon!'"

Among the Chinese the belief exists that the moon during an eclipse is being devoured by a hungry monster. In order to frighten him away, and to save the moon from total destruction, certain ceremonies are performed by the Chinese mandarins, which form, in fact, part of their official business. An instrument made of bamboo splints is beaten, which makes a great noise, supposed to penetrate the very temple of Heaven itself. Tapers are lighted at the beginning of an eclipse, incense is burned, the mandarins prostrate themselves on the ground, and the priests recite formulas, all this lasting until the eclipse has passed off. We are naïvely told that they are invariably successful in driving away the hungry monster.‡

At one time in Canton the sky happened to be cloudy during an eclipse, and we are told that the courtiers congratulated the emperor that he had been spared the pain of seeing the sun devoured.

Among some of the American Indian tribes a belief exists that the moon is hunted by huge dogs, catching and tearing her till her soft light is reddened and put out by the blood flowing from her wounds.

"At a lunar eclipse the Orinoco Indians would work hard, as they imagined the moon was veiling herself in anger at their habitual laziness." §

It was customary among the Romans to take their brazen pots and pans and beat them together, making a most unearthly noise, during an eclipse. They also lit torches and firebrands, and carried them about with them, hoping by these means to release the moon. The Mexicans would make a great noise during the eclipse with musical instruments, and would make their dogs howl, hoping the moon would have pity on them because of their cries. The Creeks did likewise, and they explained this strange custom by saying that the big dog was swallowing the sun, and they could prevent him from doing so by whipping the little ones.

The people of Tahiti were filled with terror during an eclipse, and would go to the temple and pray for the moon's release. They would offer presents to the god whom they supposed to be swallowing the moon.*

The Sinalos fancied that a battle was taking place in the moon, of great consequence to those on earth. The people would encourage the moon by shouting and yelling, and would shoot flights of arrows at her, so as to distract the enemy.†

In eclipses of the moon the Greenlanders carry boxes and kettles to the roofs of their houses, and beat on them as hard as they can. The Lithuanians think a demon is attacking the chariot of the sun; darkness comes, and though the sun will be saved many times, yet it must be destroyed at the end of the world. Among the Moors the people run about as if mad during an eclipse, firing their rifles, so as to frighten the monster, who, they suppose, wishes to devour the orb of day. The women bang copper vessels together, making a noise to be heard at a very great distance.‡

* "Fairy Tales: their Origin and Meaning." By John Thackray Bunce, p. 131.
† Grimm, "Teutonic Mythology," p. 707.
‡ Max Müller, "Chips from a German Workshop," vol. ii. p. 269.
§ Harley, "Moon Lore," p. 161.
‖ Ibid. p. 168

TRICKS OF MEMORY.

MEMORY, which differs so greatly among individual men, varies also in such marked degree in the same person at different times that we are all interested in the inquiry how far memory is a measure of mental strength. In childhood and boyhood we find memory occupying so high a position among mental qualities, that the idea grows up with most of us that he who has the best memory has also most talent, if even a remarkable memory be not regarded as of itself proving absolute genius. At least this is so in most of our schools, where the boy who remembers his lessons best takes highest position, not he who best understands them.

I learned very early that memory and mental power, though they may be associated together, are yet very different things. I valued my memory, which had often stood me in good stead in examinations, the only tests with which boyhood is apt to be acquainted; but I valued more the power of understanding and enjoying the reasoning of dear old Euclid, the one geometrician with whom, in those days, English school lads could become acquainted. Soon after I had left school—and when I was a freshman at college—I made the acquaintance of a young man of about my own age who possessed a most marvellous memory, while he also showed most marvellous mental density. He had occasion to pass examinations in Euclid, and one would have said that he would have been singularly successful in these examinations, for though he had only read through our college Euclid once, he could recite or write out the whole of it. Or, if preferred, he could begin at any point where one might start him and reproduce any quantity *verbatim et literatim—atque punctuatim*, so far as that was concerned. But not only was he utterly unable to understand a word of it all—he had not even brains enough to keep his real ignorance of Euclid to himself. He was always forgetting the good old rule *ne quid nimis*; and as he did not know where to stop in his marvellous recitations, the examiners naturally came to the conclusion, perfectly justified by the facts, that though he knew his Euclid by heart he knew nothing about geometry. His knowledge was akin to that of one who should repeat by rote a number of Greek or Hebrew words the meaning of which was unknown to him; or like that of a tutor I once had,

* Harley, "Moon Lore," p. 173. † Ibid. p. 173.
‡ Grimm's "Teutonic Mythology," p. 707.

who when hearing me deal with a problem in Euclid would send me back to relearn my lesson if I called a triangle A C B instead of A B C as the book showed it.

We need not then either despair of our mental powers when we hear of marvellous feats of memory, or think that our minds are failing because with advancing years our memory may occasionally play us false. Memory, as Dr. Diordat, of Montpelier, long since pointed out, and as hundreds of facts show, is rather the offspring of the vital force than of the intellectual principle; and it is not surprising if in old age, when the vital force diminishes, memory should sometimes fail, even while the intellectual power preserves its full integrity. As for marvellous feats of memory, though they certainly indicate possibilities of future developments which would greatly increase man's grasp over mental problems, they need no more discourage those who feel incapable of any achievements in this line than the mental powers of Blind Tom should cause those who see his performances to despair because they can never hope to do the like.

The examples themselves which most strikingly display the capacity of special brains for remembering words and syllables show also how little this capacity has to do with intellectual power—some of them indeed seem almost to suggest that a very keen memory may be a mark of disease. That excessive keenness of memory may result from a diseased cerebral action is indeed certain; but fortunately we are not obliged to regard this fact as giving any unpleasant significance to exceptionally good powers of remembrance. If foolish, or even idiotic persons, or persons in the delirium of fever, have manifested remarkable memories, men like Macaulay, Prescott, Euler, and others have had marvellous memories without being feeble-minded and without the aid of disease.

Pepys tells us of an Indian who could repeat a long passage in Greek or Hebrew after it had been recited to him only once, though he was ignorant of either language. This man would doubtless have been able to repeat (so far as his vocal organs would permit him to imitate the sounds) the song of a nightingale or a lark, through all its ever-varying passages, during ten or twenty minutes, and with as much understanding of its significance as of the meaning of the Greek and Latin words he recited so glibly. We certainly need not envy that particular "poor Indian" his "untutored mind," though as certainly the power he possessed would be of immense value to a philosopher.

If any one is disposed to believe that perhaps after all that Indian may have been a man of powerful understanding, a case of even more wonderful recollection of mere sounds will at least dispose of the idea that the man's peculiarly retentive memory proved mental power. Coleridge relates, in his "Literaria Biographia," that in a Roman Catholic town in Germany a young woman who could neither read nor write was seized with a fever, during which, according to the priests, she was possessed by a polyglot devil. For she talked Latin, Greek, and Hebrew, besides uttering sounds which, though not understood by her hearers, had doubtless meaning, but belonged to languages unknown to them. "Whole sheets of her ravings were written out," says Coleridge, "and were found to consist of sentences intelligible in themselves, but having slight connection with each other." It appeared rather inconsistent with the theory of demoniac possession that some of these sentences were Biblical; but as it is proverbial that the devil can quote Scripture for his purpose, this evidence might not have availed to save the girl from such rough treatment for her "possession" as would probably have served very ill for her fever. Fortunately, a physician, who, being sceptically inclined, was disposed to question the theory of a polyglot spirit, "determined to trace back the girl's history. After much trouble he discovered that at the age of nine she had been charitably taken by an old Protestant pastor, a great Hebrew scholar, in whose house she lived till his death. On further inquiry it appeared to be the old man's custom for years to walk up and down a passage of his house into which the kitchen opened, and to read to himself in a loud voice out of his books. The books were ransacked, and among them were found several of the Greek and Latin fathers, together with a collection of Rabbinical writings. In these works so many of the passages taken down at the young woman's bedside were identified, that there could be no reasonable doubt as to their source."

If the girl had remembered these passages in a normal way, and had merely uttered them during her sickness, the story would have been remarkable enough, since she was altogether uneducated. But, as a matter of fact, she remembered none of them in health, either before or after her sickness. It was doubtless the activity of the circulation during the access of fever which brought out as it were the impressions of sounds really recorded in the brain, but so lightly that except during such situation she remained unconscious even of their existence.

A case cited by Dr. Abercrombie confirms the suggestive theory that the stimulus which fever gives to the circulation (sign of disease though it is) may bring dormant mental impressions into temporary activity. A boy at the age of four had undergone the operation of the trepan, being at the time in a stupor from a severe fracture of the skull. After his recovery he retained no recollection either of the accident or of the operation. But at the age of fifteen, during an attack of fever, he gave his mother an account of the operation, describing the persons who were present, and even remembering details of their dress and other minute particulars.

Even an accident may stimulate the memory in such sort as to recall long-forgotten neutral impressions, and so to convey that the mind is regularly retentive. Dr. Abercrombie relates a case of this kind which suggests many perplexing problems in regard to memory. A man who had been completely stunned by a blow on the head remained still partially out of his mind when he had recovered from the first effects of the blow. In his unconscious state he spoke a language which nobody in the London hospital to which he had been removed could understand, but which was presently found to be Welsh. It was subsequently discovered that, though Welsh by birth, he had been thirty years away from Wales when the accident occurred, and had quite forgotten his native tongue. On his restoration to full consciousness he lost his Welsh again completely, but recovered his English.

The effects of an accident—in destroying temporarily, or, so far as it appears, wholly—all neutral impressions received within certain intervals, are sometimes curious enough. Thus Dr. Carpenter mentions the case of a friend of his—a clergyman—who was pitched out of a phaeton, and received a severe concussion of the brain. On recovering he found that he had forgotten all that had happened, not only when the accident actually took place, but during some previous time. The last thing he remembered was that he had met an acquaintance on the road just about two miles from the accident.

An access of fever may produce, as we have seen, a local disturbance of brain functions. It is further worthy of notice also that the recollection a man has of events preceding intoxication is apt to be similarly limited in a definite but not readily explicable manner.

I remember a Cambridge man who, though not given to

drinking, and now "a sober man among his sons," was more than once overtaken by liquor during the time when he had yet to learn his brain's exceptionally limited power of resisting the action of intoxicants. This man would not only be unable to recall what had happened during the time when he was intoxicated, but a number of preceding events which had taken place while he was still perfectly sober. His friends would tell him of things which had happened a full hour before he was "overtaken" (as the quaint expression has it), which had altogether passed from his remembrance. He used to say that his recollection was clear up to a certain point, beyond which everything seemed "veiled."

But it was clearly shown by an experiment which he arranged for his own satisfaction—being one of the inquisitive sort—that the veiling was, as it were, extended backwards from the time of actual intoxication, for whereas his forgetfulness extended over the whole interval from the first glass of wine (which he always remembered drinking) to the sixth or seventh at which intoxication began, he could remember with accustomary readiness all that happened at a sitting where he had drunk four or five glasses of the same wine. Of course he had to trust to his friends to note for him at what stage intoxication began; in fact, until he had learned this from others he could know little about it, because of the peculiar veiling of past events which took place after he had passed that stage. But his friends not being of the sort who rejoice to see a man under the influence of liquor, he had confidence in them; and besides, he could prove so much as this for himself, that whereas he could never remember more than the first glass if he drank too much, he could drink four or five glasses safely, remembering all that happened. What he could not learn for himself was, how many more glasses he could take without intoxication. At last he could only obtain this knowledge in such sort that he was conscious of it while intoxicated; for his friends found that after the sixth or seventh glass, which produced intoxication, he could always remember every detail of what had happened during previous accessions of the temporary insanity we call drunkenness.

The way in which this man's mind came out from the "veiling" was as strange and as suggestive as the way in which it was thrown under that veiling. I remember being present at the moment when consciousness or sanity (whichever we choose to call it) came back to him. He was a mathematician, and a man had put in his hand to test his condition a mathematical treatise on mechanics, over which my friend had maundered, as drunken men will. Suddenly his mind seemed to straighten up, and, in response to a remark that he was "screwed," he turned to the pages in the book dealing with the screw, and said quaintly, "See here, A. You're a classical man, and know nothing about mathematics; but these angles, Alpha and Beta" (showing a diagram) "represent the pitch of these screws. Now you needn't pitch into me about being screwed, for if I'm screwed at an angle Alpha, you're screwed at an angle Beta." (A. really was at the time the worse for liquor, but the other who had been so a moment before, was, from the moment he had opened the book, perfectly clear-minded, and a few minutes later was at his mathematical studies.)

Mr. Nordenskiöld some time ago received an account from Don Carlos Stolp, of San Fernando, Chili, of his observations of the "red sunsets" of 1883-1884, from a point on the Andes about 15,000 feet above the sea, and afterward Señor Stolp sent some specimens of an atmospheric dust which he had observed at the same time. Analysis of this dust showed that it had no relation to volcanic dust, but that it was of the kind regarded as cosmic dust—containing the iron, nickel, phosphoric acid, and magnesia constituents characteristic of the cosmic deposits. There is, however, no evidence that this dust was connected with the red light.

EDISON'S PHONOGRAPH.

IN answer to questions about his phonograph, Mr. Edison said recently:—

"Perhaps I am wrong in telling you anything about my phonograph, because what I claim for it is so extraordinary that I get only ridicule in return. I am so confident that when the apparatus appears it will dispel all doubts as to its practicability and working value, that I can afford for the present to ignore all kinds of criticism, and keep at my work regardless of the storm which I have been raising by telling a few people that there was such a thing as a perfected phonograph in existence. I am sure that while scientific men may doubt that I have succeeded as well as I say I have, they will admit that there is nothing at all impossible in what I claim, and that the germ of the perfected phonograph, should such a thing appear, is very clear in my old toy of ten years ago, which was exhibited all over the country, and was then acknowledged to be one of the wonders of the century. Just consider for a second what my old phonograph is, and think how little needed to be done to bring it to a working instrument. With my roughly-constructed instrument of 1877 I reproduced all sorts of sounds, getting back from the phonograph something like the original sound. Of course you had to yell into the thing; and the reproduction of conversation was often something of a caricature of the original. Nevertheless, to obtain a result that could be understood was doing wonders; and most people who remember my exhibitions will admit that, while I did not produce a commercial machine, I made a very interesting and creditable attempt, and my whistling and singing phonograph was a wonder.

"There were all sorts of objections in detail to my first instrument. It weighed about one hundred pounds; it cost a mint of money to make; no one but an expert could get anything intelligible back from it; the record made by the little steel point upon a sheet of tin-foil lasted only a few times after it had been put through the phonograph. I myself doubted whether I should ever see a perfect phonograph, ready to record any kind of ordinary speech and to give it out again intelligibly. But I was perfectly sure that if we did not accomplish this, the next generation would. And I dropped the phonograph and went to work upon the electric light, certain that I had sown seed which would come to something. For ten years the phonograph has come up in my brain automatically and almost periodically. I would turn it over and over mentally when I had nothing else to think about. When I couldn't sleep at night, when travelling, when worried about business affairs, I would think the phonograph over and jot down any new ideas for future experiments. Eight months ago I began laboratory work upon it again, and a month ago I stopped because I could see no further improvement to be made. It is a finished machine—simple, cheap, effective, not liable to get out of order, and it does everything that I ever hoped the perfected phonograph might do.

"My phonograph will occupy about as much space on the merchant's desk, or at the side of the desk, as a typewriter does. It will work automatically by a small electric motor, which runs at a perfectly regular rate of speed, is noiseless, and starts or stops at the touch of a spring. Suppose the merchant wishes to write a letter, he pulls the mouthpiece of the phonograph to him, starts the motor with a touch, and says what he has to say in an ordinary tone of voice. When he has done he pulls out a little sheet and rolls it up for the mail. The recipient places this sheet in a similar phonograph, touches the motor spring, and the instrument will at once read out the letter in a tone more distinct

clearer, more characteristic of the voice of the writer than any telephone you or I ever heard. The phonograph voice is not a loud voice, perhaps not more than twice as loud as the sound you get from a good telephone, and an earphone will be necessary. This, however, may not be an objection, inasmuch as people do not always want to have their letters heard all over the office. In aiming for loudness in the phonograph, I went astray in my first experiment; I should have tried for clearness. The present apparatus will satisfy any one who is half-satisfied with the telephone. Of course, there are no disturbances in the phonographic message such as those made by induction along a telephone wire, and, as the apparatus will repeat the letter over and over again, it is possible to understand every syllable, even in a noisy office. I was so overcome with the success of my first instrument, finished about six weeks ago, that I doubted whether I could make another equally good, and I went to work at once to do so. My second instrument works as well as the first, and I have forty workmen employed in making the tools for the manufacture of the first lot of 500 phonographs. They will cost 60 dols. apiece.

"Now for some speculation as to what people may do with the phonograph. I am confident that it will be found in the office of every busy man. I am confident that the editor and the reporter of the future will never think of losing time by writing with a pen or dictating to a stenographer when the printer can set type better from the dictation of the phonograph than he can from copy. I have already perfected an apparatus which allows the phonographic message to be given out in pieces of ten words each. The printer touches a pedal with his foot and the phonograph says ten words. If he sets the ten correctly, he touches the pedal again and gets ten words more. If he is in doubt he tries another pedal, which makes the phonograph repeat. In the future some method may be found of combining the phonograph and the telephone—that is to say, the phonograph may be made so delicate as to take down the sound from a telephone and give it out again when wanted. As yet I have not attempted any such thing. The vibrations of the telephone diaphragm are too delicate for use in the phonograph. In business I think that the phonograph will be used everywhere. Outside of business it is hard to say exactly to what uses it may be put. As it will record and repeat any kind of musical sound, and as the process of duplicating the phonogram, as I call my sheet of metal which has passed through the phonograph and become impressed with certain sounds, is very cheap, the phonogram copy of a lecture, a book, a play or an opera need cost but a trifle.

"For music, I know that you will simply laugh when I tell you what I have done with the two instruments that I have finished. I have got the playing of an orchestra so perfectly that each instrument can be heard distinct from the rest; you can even tell the difference between two pianos of different makes; you can tell the voice of one singer from another; you can get a reproduction of an operatic scene in which the orchestra, the choruses, and the soloists will be as distinct and as satisfactory as opera in this sort of miniature can ever be made. Opera by telephone has been done in Paris and London more or less successfully, but the phonograph will eclipse the telephone for this purpose beyond all comparison, and phonographic opera will cost nothing, because the phonogram can be passed through the phonograph, if necessary, a thousand times in succession, and once the machine is bought there is no other cost beyond the trifle for phonograms. For books, the phonogram will come in the shape of a long roll wound upon a roller. To make the first phonographic copy of a book, some good reader must of course read it out to the instrument; once that is done, duplication to any number of thousand or million copies is a simple mechanical work, easy and cheap. Now, just think a moment what that means.

"Suppose you are sick, or blind, or poor, or cannot sleep. You have a phonograph, and the whole world of literature and music is open to you. The perfected phonograph is going to do more for the poor man than the printing-press. No matter where he is, the poor man can hear all the great lectures of the world, can have all the great books read to him by trained readers, can hear as much of a play or an opera as if he was in the next room to the theatre, and all this at a cost scarcely worth mentioning. I remember that when the telephone was first announced it was said that now people in the wilds of Africa or America might assist nightly at the performances of the Paris Opera House; the wires from that favoured spot might run to all parts of the world. Well, we have not yet got to that, although it is a scientific possibility for the future to perfect in detail. But the phonograph will make such a thing perfectly easy. The phonographic record of a performance of the Paris Opera House can be duplicated by the thousand and mailed to all parts of the world. I don't know but that the newspaper of the future will be in the shape of a phonogram, and the critic will give his readers specimens of the performance and let them hear just how the future Patti did her work, well or otherwise. This sounds like the wildest absurdity, and yet, when you come to think of it, why not? Have I told you enough to make you believe that I am joking? Well, I am nothing of a joker, and this is all the most sober kind of statement. Within two months from now the first phonographs will be in the market."

COLLISIONS AT SEA.

By W. B. ROBINSON, Chief Constructor, R.N. (Retired).

THE interest and importance of the following communication will be recognised by all readers. "Gossip" is omitted this month to make room for this letter, which reached me at my Florida home rather late.—R. P.

"Referring to Mr. Gilbert R. Faith's paper on 'Collisions at Sea' in your November number of KNOWLEDGE, let me say that the article in question has been written under an entire mistake regarding what happens when the rudder of a ship is put over. The effect of putting the helm over when the ship is under way is to tend to make her turn, as she proceeds, nearly around her centre of gravity, and to finally revolve in almost a circle, her speed being lessened till it reaches, with the same horse-power, nearly a fixed quantity. The trials of all the ships of the Royal Navy prove this to be the case; hence Mr. Faith's supposition that a ship, so to say, pivots on her bow, is an error. I send herewith a photograph of the port bow of the *König Wilhelm*, which collided with and sunk the *Grosser Kurfürst*, from which picture it will be seen that the former ship must have struck the latter at an oblique angle with her starboard bow. The photo was taken when the ship was in dock at Portsmouth before the injured bow was touched for fitting a temporary one designed by me. The supposition that ships when turned by their helms pivot on their bows being a mistake, all Mr. Faith's deductions therefrom become erroneous.—W. B. ROBINSON, Chief Constructor, R.N. (Retired)."

[The subject with which Mr. Faith and Mr. Robinson have dealt is so important that it deserves to be very thoroughly ventilated. Mr. Robinson's statements com-

mand acceptance, being based on experiments of a decisive character. They also correspond with theoretical considerations, and I expected, indeed, when I inserted Mr. Faith's interesting and suggestive paper, to find his statements corrected *to some such degree*. For it was manifest to me, viewing the matter merely as a problem in hydrodynamics, that putting a ship's rudder over to either side must tend to cause (apart from loss of way) rotation around a vertical axis passing nearly through the centre of gravity. But I cannot agree with Mr. Robinson that Mr. Faith's deductions become erroneous. On the contrary, Mr. Robinson has proved for us that Mr. Faith's main deduction is sound. If two ships are proceeding on such a course as would bring one slantingly into the side of the other, and they are already close, following the sailing instructions will only make the collision more destructive, unless when the rudder is put over by the latter she pivots round her *stern*—which does not happen. Running directly counter to the printed instructions, would, on the contrary, give her a good chance of escape.—ED.]

MATERIAL OF THE UNIVERSE.

I HAVE just completed a chapter of a book on astronomy, in which I have had to consider the measuring and weighing of the solar system, and I must confess that although I have long been acquainted with the various facts in detail which I have found occasion to discuss in the chapter, I have risen from the study of those facts as thus collected with such feelings of awe at the marvels of our universe, and wonder at man's resolution in mastering the secrets of Nature as I have never before experienced—at least in like degree.

I propose now to run through some of the results belonging to this chapter in the history of astronomy, and then to show something of their bearing on our estimate of the universe, regarded alike with reference to its extension in space and to its duration in time.

Our earth's weight, not estimated by the comparatively rough methods of comparison in which a mountain serves as the counter weight, or the approach towards the earth's centre permitted in a mine is trusted in to indicate the earth's density, but definitely weighed against known masses of matter, amounts to about 590,654,000,000,000,000,000 tons—a mass easily expressed in numbers, but utterly inconceivable by the human mind. The moon, at a distance of 238,830 miles, has a mass equal to about one eighty-first part of the earth's; but even her smaller mass is as hopelessly beyond our powers of conception as that of the great globe on which we live. I am not sure but that, looking on the moon as she rides high above the horizon and noting how small she looks, queen though she be of the orbs of night, there is not something more impressive in the thought that that calmly beautiful globe contains 7,300,000,000,000,000,000 tons of such matter as makes the mass of our earth, than even in the consideration that our earth weighs nearly eighty-one times as much. The earth had always seemed the very emblem of stability and massive might, insomuch that though man in his days of ignorance imagined comparatively narrow limits to his terrestrial domain, there were hardly any limits to the mass or quantity of matter he might attribute to her. But the full size of the moon is visible to every human eye; and the contrast between the apparent and the real is much greater when, for example, we consider that that silvery surface at which we look yonder is 2,160 miles in diameter and contains 7,300,000 square miles of just such rock surface as we have on our earth, than when, looking out upon our earth as far as the eye can reach, we learn that the real extent of the earth is many thousandfold greater than the area thus surveyed. And if this is so in striking degree in regard to the moon's apparent size, it is still so in more impressive manner when we consider her mass.

Passing beyond the moon to the region of space outside, we may turn at once to the sun. Within his fiery globe lies very nearly the whole mass of the solar system. He looks no larger than the moon, but he is 60,000,000 of times larger, and more than 26,750,000 of times as massive. His mass surpasses our earth's 330,500 times, a disproportion of whose full meaning we can only form a fair idea by considering separately first the inconceivably large mass of the earth, and then the enormous number represented by the figures 330,500. On this last point I may remark that few (so far as my observation has gone) form definite conceptions of the meaning of large numbers, even when such meaning is well within their power of appreciation.

To most men 300,000 is a number which, even when it represents money, is not definitely differentiated in the mind from such numbers as 200,000 or 400,000, or even from such numbers as 30,000 or 3,000,000. Yet there are simple ways of obtaining a clear idea of what it represents. Draw a straight line 10 inches long, and, completing a square on it, divide up this square into 100 small squares by lines 1 inch apart drawn parallel to the sides. Take a corner square, and, dividing its sides into tenths of an inch, divide it like the large one into 100 small squares. Then the meaning of the number 10,000 is very clearly shown so soon as we notice that our 10-inch square contains 10,000 such squares as make up the 1-inch corner square. The eye *sees* in this case the degree in which 10,000 surpasses 1; and we all know the truth of old Horace's saying, *Segnius irritant animos demissa per aures, quam quæ sunt oculis subjecta fidelibus*. It is now easy, without further drawing, to imagine ten such squares as our large one, and thus to recognise the significance of the number 100,000. Thirty such squares would picture the meaning of 300,000, the small tenth-of-an-inch square in the corner being the unit. And thus we can readily form a good mental conception of the degree in which the sun's mighty mass surpasses the earth's—though we still remain, and must for ever remain, unable to appreciate the stupendous significance of the six hundred millions of millions of millions* or so of tons contained within the bulk of our terrestrial home.

* According to our English system we call this six hundred trillions. In America the expression would be quintillions. I object altogether to use an expression which has no true significance. It includes the number 5 (quint); but no 5 is logically includible in it. A quintillion, according to the English system of numeration, signifies a million raised to the fifth power; according to the American (want of) system, it signifies a million multiplied by a thousand raised to the fourth power. One can get a 5 in, indeed, thus: A quintillion is a thousand multiplied by a thousand raised to the fifth power; but that is an obviously unsymmetrical way of representing a thousand raised to the sixth power. If the American system were sound logically and mathematically, it would not be so convenient as the English system, for when we get into such numbers as trillions, quadrillions, and so forth, which only happens when we are comparing numbers all of which are very large, it is desirable not to confuse comparison by having too many different names, or (which is the same thing) by separating our classes of numbers by divisions too closely set. Lastly, in giving names to large numbers the English system is superior to the American, though there is no difference in the numbers of words employed. The first example, taken at random, will serve to show this to the logical arithmetician. Let the number be 324,565,482,793,812,456,259: for this the American name would be three hundred and twenty-four quintillions, five hundred and sixty-five quadrillions, four hundred and eighty-two trillions, seven hundred and ninety-three

One of the most impressive thoughts respecting the sun's mass is the might which it represents—might absolutely essential to his rule over the solar system. To give by a simple example an idea of the sun's tremendous power, imagine an immensely powerful magnet acting at a distance of one mile on a particle of iron, and try to conceive the slow motion by which at first that particle would respond to the magnetic attraction. Now suppose this magnet replaced by a body having the sun's attractive might, but all collected in a one-inch globe; and suppose, further, that this concentrated sun acts on a body from the distance of a mile all the time (a whole second is all the time I ask for), retreating from the body as, under its attractive influence, the body moves towards it, and so always maintaining that distance of one mile unchanged. Then, in that second, the attraction on the body would be so great as to communicate a velocity of 31,600 millions of miles per second. Or, in a period of time so inconceivably short as one millionth part of a second, our sun's mass, concentrated into a one-inch globe, would at a mile distance (kept unchanged) communicate the tremendous velocity of 31,600 miles per second.

Our sun surpasses in mass all the members of his family together more than 745 times, so that there is no question of his absolute supremacy over that family. Yet Sir John Herschel fell into a mistake when he asserted that, if all the planets were in a row on the same side of the sun, each at its proper mean distance from the sun, the centre of gravity of the whole system would lie far within the globe of the sun. The centre of gravity would be 937,000 miles from the sun's centre. This does not prevent the sun from exerting supreme sway over the planets, however. Indeed, the fixed centre round which the sun and all the planets travel—this centre being the centre of gravity of the solar system at the moment—is nearly always within a much smaller distance from the sun's centre than I have just named, since it very seldom happens that even three of the chief planets of the system conjoin their influence on the same side of the sun. The sun's motion around the common centre may be regarded as made up of motions in a nearly circular ellipse at a mean distance of 460,000 miles due to Jupiter's attraction, in another at a mean distance of 253,000 due to Saturn's attraction, and in two others at mean distances of 79,000 and 145,000 miles respectively, due to the attractions of Uranus and Neptune, all other attractions being relatively inappreciable.

And just here I cannot but touch, in the way of correction, on the strange mistake made by my friend Mr. Mattieu Williams in imagining that the motion of our sun in the path thus determined, about the common centre of gravity of the solar system, can in any appreciable degree affect the condition of the sun's interior. He has presented in his suggestive book, "The Fuel of the Sun"—a book full of novel ideas, but not free from startling mistakes—the quaint notion that as our sun goes circling round and about the common centre of gravity of the solar system, his material is swayed about with all sorts of effects and influences, stirring it up, intermingling it, keeping it active, and so forth, as might happen, for example, if the glowing fuel within some great furnace were constantly stirred up by the swaying round of the whole furnace by some powerful mechanism. The mistake is, perhaps, a not unnatural one. Something akin to it was made even by so skilful a mathematician as Professor Simon Newcomb, when, in the first edition of his "Popular Astronomy," he presented the tides as a product of centrifugal tendencies called into action as our earth circles around the common centre of gravity of the earth and moon.*

Mr. Williams's idea about a stirring up and shaking together of the solar fuel is entirely erroneous. If the sun were swinging bodily round a fixed axis, in such sort that while some parts of his mass (being near to that axis) moved much, there would result a certain stirring up of the solar material which might, for anything I know to the contrary (though I have given no attention to so purely hypothetical a case), have some such effects as Mr. Williams imagines. But there is no such swinging. The sun moves as a whole (with inconceivably slow motion, too), around or upon his somewhat complex orbit, each particle moving in an orbit of exactly the same size, so that there is no relative motion among the different parts of his mass, and therefore no strains or pressures are produced and no interchanges of position occur.

I imagine that few recognise fully the next most striking feature of the solar system after the amazing superiority of the sun's mass—I mean the startling discrepancy between the outer family of planets and the inner. Each contains four primary bodies—Jupiter, Saturn, Uranus, and Neptune forming one, Mercury, Venus, the Earth, and Mars forming the other. But while the combined mass of all the four inner planets is not quite twice the mass of the earth, the four outer planets together exceed the earth in mass no less than—in round numbers—450,000 times. Can we possibly regard two families so disproportioned as resembling each other in kind? I have been engaged now so many years in endeavouring to persuade students of astronomy, both on *à priori* grounds and on the more satisfactory evidence of observed facts, that the giant planets are unlike the terrestrial planets even as they are unlike the sun, each forming a definitely distinct class, that though I may say I have now succeeded, I can hardly expect very readily to persuade the general reader that Jupiter and Saturn must be altogether

billions, eight hundred and twelve millions, four hundred and fifty-six thousand, two hundred and fifty-nine; the English name for the same number is three hundred and twenty-four trillions, five hundred and sixty-five thousand four hundred and eighty-two billions, seven hundred and ninety-three thousand eight hundred and twelve millions, four hundred and fifty-six thousand two hundred and fifty-nine. Each name contains forty words, but the English, with its hundreds of thousands of trillions, billions, millions, and units, is much more systematic, and conveys a much clearer idea than the American with its hundreds of quintillions, quadrillions, trillions, billions, millions, thousands (observe the entire change in the character of the nomenclature here), and units.

I think it hardly necessary for me, after now some fourteen years, during which I have shown the utmost readiness to appreciate things American at their full value—a readiness which many among my fellow countrymen regard as extreme and unpatriotic (though that is nonsense)—to explain that it is from no desire to find fault that I thus dwell upon the unscientific and illogical nature of the system of numeration adopted in American schools. The system, employed as it now is, throughout the whole of the great American section of the English-speaking race, involves serious inconvenience from the mere fact that it differs from that employed elsewhere where English is spoken and written. Probably when it was introduced American arithmeticians hardly looked forward to the time when America would take so large a share of the scientific work of the English-speaking races as she does at present.

* I was rather interested in this mistake, because on the strength of it, and a kindred mistake about the earth's reeling motion in 25,868 years being similarly caused, I had been taken sharply to task by the editors of "Johnson's Cyclopædia" for not introducing some such explanation of the tides and of precession into the astronomy of the "American Cyclopædia." Here, wrote my severe and anonymous critic (or to this effect), was our American astronomer, all ready with a new cut-and-dried explanation of these phenomena, and Messrs. Appleton pay this "blawsted Britisher" for reproducing the old one. The old one, however, chances to be right; the new one (as it appeared shortly after in the first edition of "Newcomb's Astronomy") is wholly wrong; and even in the very mild and modified form in which it appears in the second edition, it has no value whatever as an original explanation, being only a recondite way of presenting the most unsatisfactory portions of the old one.

unlike our terrestrial home, and must have had in the past, as they will have in the future, quite different life histories. But such is certainly the case. It might be inferred from what we know of the disproportion of the masses, and all the more certainly from what we have recently learned to consider extremely probable respecting their general resemblance in structure. (For, unlike collections of unlike materials might by some strange chance have like life histories; but such similar life histories could never occur in unlike collections of like materials, or in like collections of unlike materials.)

It is, however, noteworthy how, even within each family of planets—the family of giant planets and the family of terrestrial planets—differences of size and mass exist which suggest marked differences of life history, and also enable us to infer from analogy great differences among the component members of higher systems, as sidereal systems, systems of such systems, and so on to higher and higher orders endlessly. I have said that the whole of the inferior family of planets is less in mass than twice our earth; in other words, our earth surpasses all the rest put together. Venus in turn surpasses Mars, Mercury, and the moon together; Mars surpasses Mercury and the moon together; each member of the family, in fine, surpasses all those less than itself taken together. Turning to the family of giant planets, we find the same law there. Jupiter surpasses Saturn, Uranus, and Neptune together some two and a half times; Saturn surpasses Uranus and Neptune together more than threefold; Neptune surpasses Uranus and all the rest (moons, rings, &c.) of the outer system, with the whole system of terrestrial planets and satellites thrown in.

(*To be continued.*)

LARGE TELESCOPES.

I HAVE been glad to notice that my friend Professor Young has come round to the opinion I have been somewhat strenuously maintaining, that the great telescopes which have lately been made are capable of better and more interesting work than hitherto has been accomplished with them. I have not seen yet the article itself in the *Forum*, wherein Professor Young has indicated the value of great telescopes, and the way in which work done with them can increase our knowledge and extend the horizon of astronomy; but I have before me a characteristic passage from his essay, the tone of which shows clearly that Professor Young fully indorses the views I have expresed respecting the fine telescopes made so skilfully by the Clarkes and others, and (in several cases) presented so generously to astronomers by men or societies of adequate means.

"The reasonableness of wanting larger telescopes still," says Professor Young, "is identically the same as that of wanting a telescope at all." This, though somewhat tautologically expressed, is in reality the essence of the whole matter. Astronomy wanted telescopes that more of the universe might be seen and studied, and as far as possible understood; and each increase of telescopic power has come in response to the longing of astronomy for a wider range of view, increased insight and better understanding of the wonders which lie concealed from ordinary vision in the remote depths of space.

When one of these far-seeing eyes of astronomy, promising keener vision than had yet been attained, has been provided, and when one of the observing army of astronomy has been set in charge of it, high expectations are naturally formed respecting the work it will accomplish. No one who understands optical laws can for a moment doubt that such a telescope will do more than one of inferior light-gathering power. This is so, even though a smaller instrument be to some degree superior in actual quality; but as a matter of fact our opticians are improving year by year the quality of their instruments while increasing the size of the great eyes they make for scanning star-strewn space. Accordingly astronomy has a right to expect that, even though no actual discoveries may be made by means of a new telescope of superior qualities, the details of objects already known will be better examined, and so be more fully understood.

As Professor Young well says, "It is not possible now to go out at night as some seem to think"—who must be entirely ignorant of the work astronomy has already done—"and pick up discoveries as one would gather flowers in a forest; but we may be sure of this," the large telescope "will collect data, with micrometer, camera, and spectroscope, which will remove many old difficulties, will clear up doubts, will actually advance our knowledge—and what is still more important, will prepare the way and hew the steps for still higher climbing towards the stars." The last half sentence may have more metaphor than meaning, more rhetoric than reasoning; but though we may not quite know how much Professor Young really means by hewing out steps for climbing towards the stars (after all this is not more highfalutin than Horace's "star-striking with his sublime top"), his main argument is sound. A larger telescope, even when used only for going over ground already surveyed with smaller ones, is capable of doing most important and valuable work. The small telescope may discover objects, precisely as the naked eye discovered the sun and moon and planets; but the larger one will show better what those objects really are, revealing details which before had been either wholly unseen or so imperfectly seen as to be misunderstood. A larger telescope still will show the details of those details, and fresh details, to be still further and more completely analysed when higher powers are applied—*if only the larger telescope is zealously applied to such work.*

Many interesting examples might be cited of the way in which large telescopes properly used complete the work begun by smaller ones.

Consider, for example, the discovery of the strange Saturnian appendage which we now know as the ring system of Saturn. As every one knows, it was Galileo, with his little telescope, who discovered that Saturn had something about him which was unlike anything yet seen. Old Saturn, said Galileo, in his fanciful way, has two satellites which attend him on his way. Later, in a more businesslike communication to Kepler, he said:—"Saturn consists of three stars in contact with one another." And last, addressing the world of science, he announced that he had observed the remotest (or the highest, "as it was still the fashion to call the most distant) planet, to be triform—*altissimum planetam tergiminum observari.* Such was the discovery of the Saturnian ring-system. No larger telescope could rediscover it; but every increase of telescopic power applied to Saturn has taught us something more about the system. Galileo was never able to understand why the attendants who guided Saturn on his way were so variable in aspect, and still less why, when he looked at Saturn in 1612, he could see no attendants at all. Hevelius, with larger instruments went some way, but not very far, towards interpreting the mystery. He analysed as well as he could the Saturnian changes, and this is his sesquipedalian report of the results he obtained: "Saturn," said he, "presents three various figures to the observer—to wit, in manner following:—first, the monospherical; secondly, the trispherical; thirdly, the spherico-ansated; fourthly, the ellip-

tico-ansated; fifthly and lastly, the spherico-cuspidated," of which many a popular reader in those days might have remarked—if there had been popular readers then—what Gilbert's devoted lover remarks of the Tupperian sentiment:—

> "A fool is bent upon a twig, but a wise man fears a bandit,"
> Which I know was very clever, but I couldn't understand it.

Hevelius meant simply, however—though he expressed himself anything but simply—that Saturn looks sometimes like a globe, sometimes like three globes, sometimes like a globe with handles, sometimes like an egg with handles, and sometimes like a globe with projections. Further telescopic research by Huyghens showed that Saturn is surrounded by a flat ring inclined to the plane in which the planet travels. Cassini's larger telescopes showed the ring to be double; further researches disclosed divisions in the outer ring; then the inner dark ring (semi-transparent, so that the planet's outline can be seen through it) was discovered; and with each increase of telescopic power fresh discoveries were made, which are going on still, and will doubtless continue to go on for a long time yet to come.

Only it is to be observed of this case, as of all such cases, that if each astronomer who was put in charge of each new telescope had been unwilling to examine with it the Saturnian ring-system because already some one else had discovered such and such details, all this pleasing progress would have been brought to an end. It will presently be seen why I dwell on this rather important consideration.

There is scarcely an object of telescopic study which has not in some such way rewarded each increase of telescopic power and each fresh inquiry by keen-sighted and earnest observers. Every planet either shows more of detail, or shows the details of its surface more clearly, or shows that details supposed to have been seen have no real existence when increased telescopic power is applied to its examination. The stars not only appear in greater numbers under such increase of power, but single stars are resolved into double, triple, or multiple stars; minute companions are resolved into sets of attendants; and movements are detected and measured which with smaller telescopes might have escaped notice, or only been recognised after a much longer time had elapsed. The star clouds or nebulæ are seen in greater detail with larger telescopes, and indeed many new nebulæ are usually discovered when higher telescopic powers than had before been used are applied to the search for them. The structure of comets is more and more clearly shown as larger telescopes are used in the study of cometic mysteries. And last, to return to our more immediate neighbourhood, the study of the sun and moon has progressed very obviously and decidedly as larger telescopes have been applied to the details of the surface of either orb.

I may take the examination of the sun's surface as illustrating in a very effective way the advantages to be derived from the use of large telescopes.

Galileo, Scheiner, and Fabricius could recognise little more than the fact that the sun has spots on his face at times, and that these spots are carried round in such a way as to show that the sun rotates on his axis. Hevelius noted the *maculæ* or mottling, and the *faculæ* or bright streaks. Wilson recognised the changing appearance of the spots, and the evidence that they are depressions. The elder Herschel recognised the corrugations. Nasmyth called attention to details which he called the willow-leaves, comparing the appearance to that which would be produced if a number of luminous objects of a form somewhat resembling that of the willow leaf were strewn on a somewhat darker ground. Dawes and Huggins showed that with better telescopes the appearance of a bright network on a darker background gave place to that of a darker network on a bright ground, and this appearance in turn to that of a number of bright grains strewn more or less irregularly over a surface which, though relatively darker, is in reality intensely bright; and lastly, Langley has shown, by yet more careful scrutiny, that these grains, the so called rice-grains, are irregular in shape; that they become elongated in the neighbourhood of spots, and that a number of forms akin in variety alike of individual shape and of combination to the cloud-forms—cirrus, cumulus, and nimbus, cirro-stratus, cirro-cumulus, &c.—seen in our skies can be recognised in the glowing photosphere of the sun. Nor can we yet tell how much more of detail, or, therefore, how much more of significance may come to be recognised hereafter in the structure of the great ruling centre of our system.

But if new telescopes of increased power are to do what they are unquestionably capable of doing, and what astronomy is entitled to expect of them, there must be no perfunctory control of the observatories in which they are erected. There is a danger (which we have recognised in the old country, and which exists, I fear, to some degree in America also) lest the large telescopes should come to be spoken of more for what they are capable of doing than for what they are doing or have done. There is further danger lest smaller telescopes alone should be busily employed, and this rather to encourage the construction of important observatories, capable of splendid work (provided with large telescopes and also managed by persons capable of drawing large salaries), than with any great desire to advance astronomical knowledge.

We have had in England one or two such marked examples of this sort of thing that (knowing human nature to be everywhere much the same) no true lover of science can fail to feel somewhat anxious lest in America also the same thing might happen. Such men as Mr. Huggins, in England, and Dr. Henry Draper, in America, doubtless enable us to entertain the hope that men like the Newtons and Herschels of past times are still among us, who are capible of working zealously at science for science's own sake.* When on the other hand we find, as we have in England, men skilful as observers making their really clever researches a sort of fulcrum for levering up a well-salaried post, and either when such post has been secured or when all hope of securing it has failed, dropping altogether their zeal for science, we begin to recognise a danger which threatens seriously the future of our big telescopes. I mean the risk that they should fall into the hands of men who have no genuine zeal for science, even though in the past they may have done good work in research. Such men there have been even among astronomers, men who have, indeed, regarded large telescopes as instruments by which remarkable discoveries might be accomplished, but who have cared for such discoveries only as stepping-stones for themselves.

* I am quite aware, even as I write these lines, that William Herschel, and in less degree John Herschel, availed themselves of the power that science gives of earning a livelihood, or even of maintaining a family, through some development of scientific research. William Herschel made telescopes for sale, and John Herschel wrote books, from the sale of which considerable sums accrued to himself and to his family. Even if the Herschels had held, as Newton did, salaried posts for work associated with science, it would in no sense have affected the distinction I draw between them and men who value scientific research *only* as a means for gaining money. Self-support, and the maintenance of those dependent upon one, are duties which come before even the advancement of science. But we see Newton's zeal for science showing itself in work done independently of all possibility of profit. William Herschel gave up remunerative business that he might devote his whole time to astronomy, on the merest chance that a portion of his scientific work might avail for self-maintenance.

I could cite, with names and dates in full and ample documentary evidence, a case which for a while created a good deal of excitement in the old country—where the suggestion was definitely made to Government that, because X had made several clever observations and a few interesting discoveries, and because X's name had thus (most men scarcely knew Y) become widely known, he should have not only a new observatory but a new kind of observatory made for him, whence he should make more observations, for only 2,000*l.* (say 10,000 dols.) per annum. It was made clear to those who for a while were rather pleased with the thought, that if X were really zealous for astronomy, the mere command of a telescope of greatly increased power would be felt by him to be an ample reward for past work, or that at least he would seek only for the means of supporting himself in comfort, *not* to be paid a lavish salary for a part only of his time. So—

> The scheme fell through,
> It would not do.

But thoughtful men noted the danger then escaped; and in England, at any rate, they will in future think twice before they plan new observatories and provide new salaries in pursuance even of the most plausible schemes for what has been pleasantly called the "endowment of research."

It is unfortunate that the question of making and using large telescopes cannot be readily dealt with without the introduction of questions so sordid (for though there is nothing sordid about self-maintenance—while the maintenance of family is a sacred duty—jobbery is *always* sordid); but the fact remains. Those who wish to see great observatories and fine telescopes doing the work of which they are capable, have generously, though somewhat thoughtlessly, concluded that the best way is to offer very high remuneration in order that the services of the best men may be secured. Unfortunately such generosity is apt to defeat its own ends. The men who jump at such offers are not apt to be the men most anxious to advance the cause of science.

How would it be if a course the reverse of this were adopted? if instead of saying, "We will offer such and such advantages, and salaries so high, that we may be sure of securing the services of the best astronomers," those who generously provide means for erecting great observatories were to say, "*We are sure to get the services of earnest and zealous astronomers if we offer all that is wanted in the way of scientific appliances—and nothing more*"?

Apropos of Mr. Lockyer's latest novelty, his "Preliminary Note on the Spectra of Meteorites" summarised (!) in five columns of the *Times* of November 18, and made the subject of a good advertising leader in the same issue, we must express our surprise at the absence of any reference to the remarkable phenomenon reported from Clayton (Ga.) in the shape of an aerolite which fell there, and on the polished surface of which was a deeply graven circle, within which was a four-pointed star, a representation of a bird-reptile, resembling in a measure the extinct archæopteryx, and a great number of smaller figures resembling those used in modern shorthand! An analysis of a fragment reveals—at least, so "H. Randolph Stevens, analytical chemist," tells us—the presence of a "new element." We can readily believe this. There must be many "new elements" in the matter, and we await with interest the promised official report, which will probably be drawn up by Captain Lawson, the author of "Wanderings in New Guinea," and his friend, a descendant of Baron Munchausen. Really, Mr. Lockyer must look to his laurels.

ROYAL VICTORIA HALL.

(*To the Editor of* KNOWLEDGE.)

THE Tuesday Popular Lectures for the last four weeks have presented much variety in their subjects. First, Sir John Lubbock gave his hearers an amusing collection of the oddities of savage life. This was followed by a mountaineering excursion to Switzerland and the Caucasus, under the guidance of Mr. Donkin, hon. sec. of the Alpine Club. We say advisedly an excursion, for the splendid photographs did all that was possible to bring snow peaks and glaciers into the presence of Londoners who could not go in search of them. Then Professor Boyd Dawkins told the ever-marvellous story of our coalfields, and finally Dr. W. D. Halliburton gave a lecture on "The Eye and How we See."

He gave a very clear and well-illustrated account of the structure of the eye, then explained so much of refraction as was necessary to understand the action of lenses, and the passage of the rays of light to the retina. He alluded to the long-standing puzzle of upright vision, and remarked that there is some reason to think that we see in virtue of a temporary photograph on the "visual purple," which is for the time being bleached by light. If a frog (the animal in which this visual purple is most developed) is decapitated in front of a window, a white inverted image of the window will be found on the visual purple of his retina. Passing on to defects of vision, Dr. Halliburton explained the causes of long and short sight, and the action of the appropriate spectacles, and insisted on the importance of attending to inflammation of the eyelids in babies, lest opacity of the cornea should result—the most frequent cause of blindness. Finally, he spoke of so-called colour-blindness, or the inability to distinguish between colours, especially red and green, which proves on investigation to be so common that it is a serious source of danger at sea and on the railway. Possibly many unexplained collisions may be due to misreading of signals on this account. One narrow escape is known to have taken place. Two vessels were nearing each other at night, with the usual lights displayed. But it happened that on board one of them both mate and steersman were colour-blind, and a collision must have taken place had not the captain happily overheard the order given, rushed on deck, and, knocking down the man at the wheel, altered the ship's course just in time.

The lectures will be resumed, after the Christmas entertainment, on January 10, when Mr. Stradling has promised a lecture on "The Great Sea Serpent," illustrated by living reptiles. He will be followed on successive Tuesdays by Mr. Rudler (president of the Geologists' Association) on "Caves and Cave Men"; Professor Bonney on "Early Modes of Burial in Bretagne"; and Professor Ramsay on "Early and Later Alphabets."

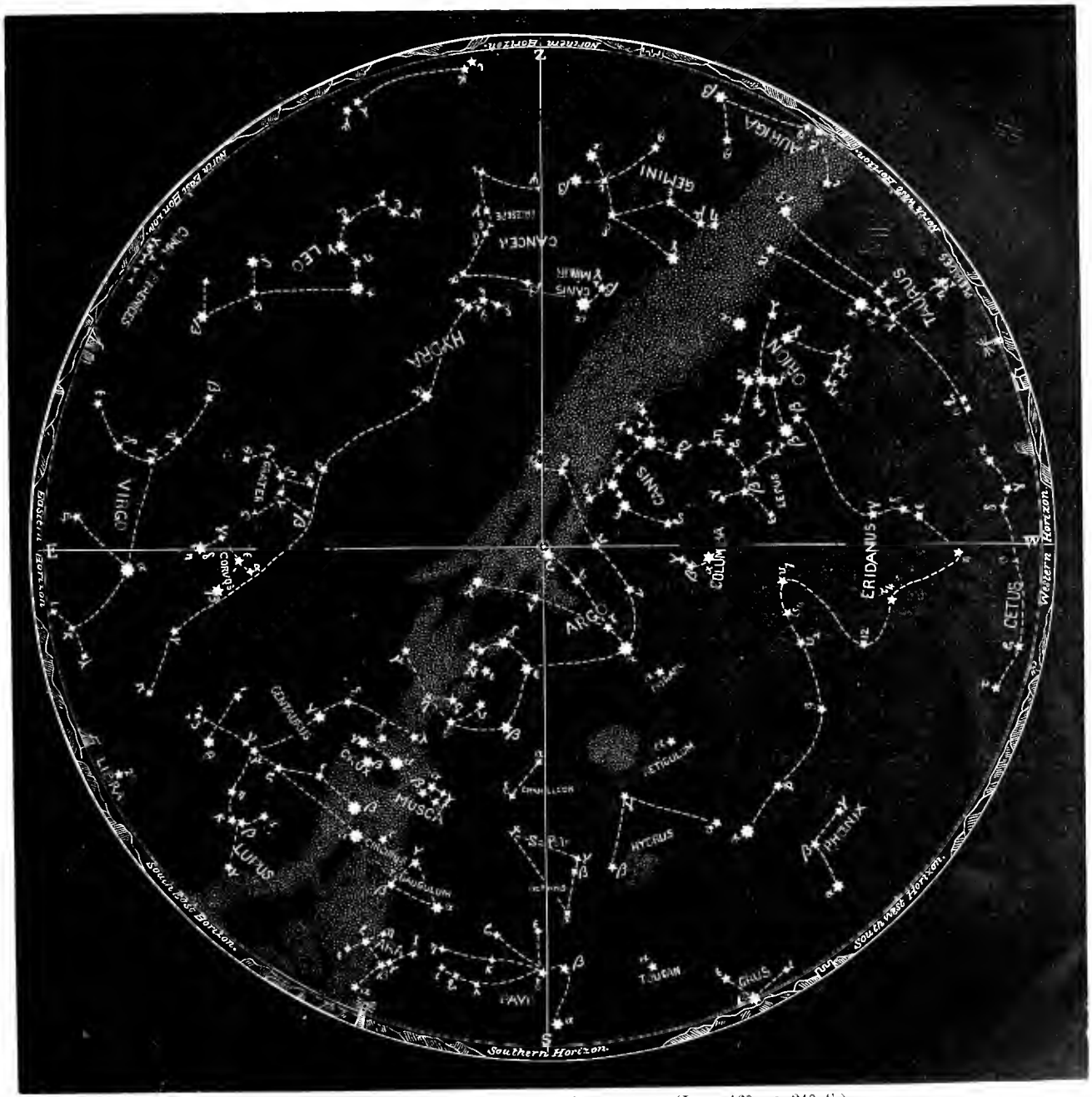
C. A. MARTINEAU.

1 Clifton Place, Sussex Square, W.

CAUSES OF IDIOCY.—Dr. T. Langdon Down, inquiring into the causes of idiocy, has found that intemperance of parents is one of the most considerable factors in producing the affection. His view is confirmed by some French and German investigators, one of whom, Dr. Delasiauve, has said that in the village of Carême, whose riches were in its vineyards, ten years' comparative sobriety, enforced by vine disease, had a sensible effect in diminishing the cases of idiocy. Nervous constitution and consumption exercise important influence. Of the professions, lawyers furnish the smallest proportion of idiots, while they are credited with the procreation of a relatively very large number of men of eminence. With the clergy these proportions are more than reversed. The influence of consanguineous marriage, *per se*, is insignificant, if it exists.

THE SOUTHERN SKIES.

MAP XV.—FOR DECEMBER, JANUARY, AND FEBRUARY.



THE NIGHT SKIES IN THE SOUTHERN HEMISPHERE (LAT. 46° TO 24° S.)

AND THE

SOUTHERN SKIES IN ENGLAND (UPPER HALF OF MAP ONLY) AT THE FOLLOWING TIMES:

At 1 o'clock, morning, Jan. 7.	At 11 o'clock, night, Feb. 7.	At 9 o'clock, night, Mar. 8.
„ 12.30 „ „ Jan. 15.	„ 10.30 „ „ Feb. 14.	„ 8.30 „ „ Mar. 15.
„ Midnight, Jan. 23.	„ 10 „ „ Feb. 22.	„ 8 „ „ Mar. 23.
„ 11.30 o'clock, night, Jan. 30.	„ 9.30 „ „ Mar. 1.	„ 7.30 „ „ Mar. 30.

STAR MAGNITUDES.

First . . . . ✱ Second . . . . ✱ Third . . . . ★ Fourth . . ✦ Fifth . . . . ▲

THE ONE-SCALE ATLAS.

MAP XI.

by Rich.d A. Proctor.

COAL.

By W. MATTIEU WILLIAMS.

THE DRAINAGE AND PUMPING OF COAL-MINES.

THE vexed question of the duration of our coal-fields would have been quite settled ere this, had our means of removing the water from coal-mines remained as they were previous to the inventions of James Watt. As I long ago explained, the end of our coal-digging will occur long before our coal-seams are exhausted, long before the physical possibilities of working the coal are exhausted. It will be determined commercially when the cost of obtaining coal at home exceeds that of importing it from abroad, or of the growing of wood. With the tread-wheels, horse-gins, water-wheels, and other pumping-machines that were in use at the beginning of the last century applied to our present workings, coal would now cost far more than firewood, and, even with the steam-engines that preceded those of Watt, it would cost nearly as much. As it is, in spite of all our improvements, there are great well-known coal-seams remaining unworked, and practically unworkable, for the simple reason that the cost of removing the water added to the ordinary cost of coal-getting would exceed the market value of the product. All this coal is, in colliers' expressive language, "drowned out."

If coal-seams occurred in non-porous rocks, such as granite and compact limestone, like the marble of Carrara (where I have walked a couple of miles underground without seeing water), no drainage nor pumping would be required, but this is far from being the case; the characteristic rocks of the coal measures are porous sandstone and shale. Here and there are alternating strata of what the sinkers call "metal," or hard compact rock practically impenetrable to water, but for the most part the rock above the coal permits the infiltration of much of the rain water that falls on the surface. That which oozes or pours through the sides of the shaft may be restrained by "tubbing," as already described, but the water that comes through the roof and sides of the roads and workings must be first collected by drainage and finally removed by pumping or hauling to the surface. There are some few dry coal-mines, of which I shall speak hereafter.

The drainage is effected by the simple device to which I have already alluded, that of beginning to work on the deep, *i.e.* at that part of the estate where the coal is deepest, and then proceeding upwards along the natural slope of the seam. The water may thus run down the roads or by special drains or "water gates," until it reaches the shaft, which is sunk to a considerable depth beyond the lowest opening of the roads in order to form a sumph or receptacle for the water, from which sumph it is drawn by winding buckets or pumps.

Some primitive coal-mines were drained without any winding or pumping. This is possible wherever the seam occurs in hilly districts and lies at a higher level than the bottom of the valley. In such cases, an adit-level, *i.e.* a narrow tunnel, may be cut from the lowest part of the intended working, through the side of the slope, into the open valley. The water, of course, flows down this into the river, or in some cases directly into the sea. This is still used wherever the configuration of the country renders it possible, but unfortunately for the present generation, our forefathers have nearly, if not entirely, exhausted such deposits of coal. It is in lead and copper mines that adit drainage is now more available.

I need not describe the mechanism of pit-pumps—pumps are pumps everywhere, and are properly described in treatises on such machines. The special feature of coal-pit pumps is their great size in some instances, and the depths from which they raise the water. In old times, when only the seams of coal near to the surface were worked, the simple so-called "suction pump" was used, acting, as in these post-Torricellian days we all know, by the pressure of the atmosphere. But this pressure could only sustain a little more than a 30-feet column of water, and therefore at greater depths, pumping by successive stages, or the use of lift-pumps or force-pumps was adopted, or more commonly in the early days the water in the deeper pits was raised by winding, by using large buckets that dipped into the "sumph" in the manner I described when on the subject of pit-sinking.

Costly as may be the raising of water from coal and other mines, its costliness has made mankind the richer. This cost was the chief stimulant to invention in the birth and growth of the steam-engine. The primitive machines of Papin, Savery, Newcomen, Leupold, Beighton, and Smeaton were constructed for pumping water from mines, and the first efforts of Watt with his separate condenser were devoted to the same object. There was a double advantage in this. Not only was the engine especially suitable for such work, but such work reacted with special benefit on the engine which had to overcome a greater deadweight than that of water down in the darkness of a pit sumph. The deadweight of prejudice had also to be lifted out of the still lower and darker depths of human stupidity, and the inventions brought to the light in spite of the resistance of vested interests. The damaging power of these detestable agents was proved by the fact that they crushed Dud Dudley's great invention of the manufacture of iron by pit coal and ruined the inventor, thereby causing a halt of about a century in the progress of this important branch of industry.

The impossibility of crushing the steam-engine and its inventors arose from the fact that its work in pumping water from mines was so easily and obviously measurable. The quantity of water raised from a given depth by the expenditure of a given amount of fuel admitted of such definite statement that misrepresentation was drowned by it.

A few figures indicating the progress we have made in this direction will be interesting. When Smeaton commenced his improvements, the average *duty—i.e.* the number of pounds of water raised one foot per bushel of coal consumed was 5,590,000. In 1772 he erected an engine at Wheal Busy which attained a duty of 9,450,000. But presently—*i.e.* between 1776 and 1779—he was beaten by Watt, and admitted that Watt's engines performed double the duty of his own. Some were tested, and proved to reach 19 millions, and the average of Watt's engines in Cornwall amounted to 17 millions. Finally, his engine at Herland attained 20 millions, and Watt was satisfied, pronounced his work perfect, and expected no further improvement. But in 1823 the proved duty had reached 28 millions, in 1843 it had grown to 60 millions, and now we even exceed 100 millions; the record of an engine erected at Fowey Consols Mine having, while worked under strict supervision during twenty-four hours, attained a duty of 125 millions. Such maximum duty is attained in Cornwall, where coal is dear, and the men in charge of the engine are (or were) rewarded according to the duty they obtained. Not so in the Black Country, where coal is so ruinously cheap, and no record of engine duty is kept.

When a seam is worked out and left, the old workings usually become filled with water, and such occupation of the

space limits the amount of collapse of the rock. But such working out may be only effected commercially—*i.e.*, the working may only be carried to the limits of the estate or royalty, not to that of the seam. Thus the same seam may be opened again on an adjoining estate, and the new workings brought close upon the boundary of the previous workings. When this is the case, great caution is necessary, the law demands that a bore-hole shall be driven forwards (six feet ahead if I remember rightly) in order to feel for the water. A serious accident occurred at Leeswood, in Flintshire, while I was there. This precaution had been neglected; an old abandoned working was broken into by the pick, and through the breach a flood of water poured, drowning seven or eight men.

Much of the coal which is now lying drowned out might be made available by co-operative pumping. This is the case where a large area is held by different landlords, and is so situated, as regards level, that neither estate can be pumped without pumping all the rest, and each refuses to pump for the benefit of his neighbours. Possibly this difficulty will be ultimately settled by the Government taking possession of the whole, and working it for the benefit of the nation; pumping all, and charging dry royalty to pay for the pumping. In this case "royalty" would return to its original signification—viz., payment to the king.

AMATEUR PHOTOGRAPHIC EXHIBITION.

THE annual exhibition of amateur photographic work held by the London Stereoscopic and Photographic Co., Limited, has become an event looked forward to with great interest by all amateur photographers and those interested in the progress of photography. The present exhibition, now open at 108 and 110 Regent Street, is quite as interesting as its predecessors—and, in fact, to one who has visited all these exhibitions a steady and marked improvement in the style and class of work is distinctly noticeable. Photographs have been sent in from all parts of the world, as many as four thousand pictures having been entered. A large number of money prizes, and gold, silver, and bronze medals, have been awarded, and the work is so excellent that in many cases the judges—Captain W. de W. Abney, Mr. T. C. Hepworth, the editor of the *Camera*, Mr. Hastings, and Mr. Duncuft—must have had great difficulty in finally deciding to whom the palm should be awarded. It is very noticeable, also, that both ladies and gentlemen seem to acquire the art of photography with great ease, and gain proficiency with wonderful rapidity; some who have now taken gold medals were, only two years ago, perfectly ignorant of the art. The exhibits now on view number 2,260 mounts, the majority of which are shown in portfolios, while a large number of the prize pictures have been framed and hung upon the walls. These illustrate an immense variety of the branches of photographic art-portraiture, landscape, architecture, warfare, animal studies, genre pictures, instantaneous views of action, micro-photography and other branches being well represented.

Taking the exhibits in their order in the catalogue, we see at Frame 1 Mrs. Edward Penton's highly commended and highly commendable views of Tintern Abbey. Frames 2 and 3 contain Mr. Harry Tolley's exquisite pictures, "White-robed Nature," a delicate snow scene, and "At Ilam, Derbyshire," to which have been awarded the 10*l.* prize given in Class I., which was open to all amateurs, and the gold medal given by the *Camera Magazine* for the best general work. Mr. Tolley also exhibits, Nos. 49, 50, 57, a beautiful platinotype of a group in a boat gathering water-lilies, and 75, a very fine interior of Exeter Cathedral. In Class II., for marine subjects, the silver medal has been carried off by Captain C. M. Harrison for his excellent pictures of yachts in motion, Frame 5. In Class III., for sporting pictures, the 5*l.* prize has been taken by Lieutenant R. B. Croft, R.N., for Frame 15, which contains seven studies of animals. The silver medal has been taken by Mr. J. T. Hopwood for his beautiful little Jersey cattle (69), while one of the bronze medals has fallen to Sir M. G. and Miss F. Harvey for their pictures of "Sport in Many Lands," two of which appear in Frame 41, and represent a dead hippopotamus and a dead buffalo, each being surrounded by a group of beaters and sportsmen. In Class IV., for the most original picture, the silver medal has deservedly fallen to the Rev. F. C. Lambert for Frame 52, which contains three pictures, viz., "The Jubilee Joke," the cleverest study of laughter that we have ever seen; "There is No Deception; the Amateur Conjuror," a capital interior and composition picture; and "The Amateur Photographer," a little girl pretending to take the portrait of another little girl and a baby by means of a camera made of an old chimney-pot hat. The bronze medals have been awarded to the Countess Oriola (45). Two pictures, called "At the Fountain"—after the Greek style—and "A Family Group" of Egyptian women and child, which is far the best of the three; and to Dr. E. W. Alabone (16) for his exceedingly comic pictures—"Going," "High Jump," and "Gone." In Class V., open only to pupils of the Stereoscopic Company, the gold medal was awarded to Mr. Howard J. Kennard for Frames 11 and 12, exquisite views of the Rhine and Switzerland; the silver medal to Mr. J. T. Hopwood for (73) "Winter" and a splendid interior, the "Music Room, Ribton Hall." In this class six medals were awarded, and the work is of the highest excellence. In Class VI., which is open only to those who have begun the art with the present year, some really remarkable work is shown. The 5*l.* prize was well won by Mr. E. A. Golledge for Frame 60, which contains eight pictures, of which the most interesting are the instantaneous views (1) of "Ladies Bathing" (284) of "Yachts in Motion," and (8) of "Yarmouth Bridge." No. 5, of children "Going for a Drive" in a goat chaise, is quite charming. Four other awards were made in this class, the silver medal being given to Mr. D. A. Clarke, M.A., for Frame 24, which contains three excellent pictures, of which the best is "Filling the Water-cart." In Class VII., open only to the fair sex, awards have been made to five ladies, Miss C. Wrigley being the winner of the 5*l.* prize for Frame 61, which contains four country pictures, of which the prettiest is another "Gathering Lilies"—a man standing in a punt on a beautiful piece of water. In Class VIII., open only to customers of the company, the 10*l.* prize has been won by Mr. G. Davison, for a set of three capital pictures (78); and ten awards have been given, one bronze medal having fallen to the Rev. H. B. Hare, whose excellent work last year makes us wish he had been more strongly represented this time. In Class IX., for officers of her Majesty's service, six awards were made. Surgeon F. M. Puddicombe, R.N., winning the silver medal for Frame 8, which contains four most interesting pictures, of which (1) "A Torpedo Boat going 16 knots an hour," and (3) "Whitehead Torpedo in the act of Explosion," are the most noteworthy. Mr. Cyril S. Cobb is the winner of the silver medal in Class X., and Lieutenant G. H. Call in Class XI. for (70), of which two views of the interior of the White Marble Palace at Delhi are very beautiful. In Class XII., open to members of the learned professions, Mr. W. Lant

Carpenter wins the silver medal for his ten photographs from fossils (81), and Mr. S. F. Clarke a bronze medal for his twenty-two wonderful micro-photographs (72). In Class XIII., for photographs taken on the company's dry-plates, Mr. Carpenter again wins a silver medal for (20) eight beautiful views, and Miss E. G. Stone a bronze medal for Frame 71, which contains five pictures, of which the best are "The Sunflower"—a beautiful little girl holding the flower in question—and "Sisters"; another bronze medal was won by Mr. A. J. Baines. The gold medal in Class XIV., for large direct photographs, was won by Mr. J. T. Hopwood for Frame 56, which contains six pictures, of which the most noticeable is "Jack," a pretty boy in sailor's dress dancing a hornpipe; while Mr. William Adcock carries off the silver medal for (54) "A Labourer's Luxury," a good rugged face with a pipe in its mouth. The two bronze medals in this class were awarded respectively to Messrs. H. Mansfield and J. E. Dumont. Mr. Dumont's (10) "His Own Barber" being exceedingly clever and amusing. The silver medal given by the *Amateur Photographer* for artistic treatment of difficult subjects is awarded to Mr. G. Davison, for "A Breezy Day in Spring" (78), and the bronze medal to Miss Miles for her studies of horses (80).

A pleasant hour or two can be spent in inspecting this exhibition, which will remain open until further notice, and which can be viewed gratis on presentation of a visiting card. Such a visit will give a very adequate notion of recent advances in photography, and is likely to encourage the visitor who is not already a photographer to endeavour speedily to acquire this charming and useful art.

DARWIN'S LIFE AND LETTERS.

I.

THESE long-expected volumes justify the eagerness with which they have been awaited. In these days, when biographical body-snatchers pounce on their victims before, as the phrase goes, the grave is cold over them, Mr. Francis Darwin reproves our haste and justifies his delay in allowing more than five years to pass before issuing this work, while he shows himself of like spirit with his illustrious father, the note of whose life is that he possessed his soul in patience. The book is executed with consummate skill and reverent care. The biographer is in no wise obtrusive; he comes between reader and subject only to supply the needed links to connect the letters which comprise four-fifths of the work, adding a sketch of his father's everyday life and methods of working, not gratifying overmuch the idle curiosity which hungers for gossip about the private life of celebrities, but just putting us on easy terms with Darwin, so that we feel we know what manner of man he was, and find every favourable impression given us by his books and his relations with his contemporaries confirmed. Looming larger than he himself dreamed among the makers of epochs, he did not strive nor cry, but kept himself from the clamour of tongues in the quiet sanctuary of home, partly because he preferred the seclusion, but also because the nature of his work demanded it, and chiefly because of the wretched health which, especially after his voyage, prostrated him for weeks together, and even under the best conditions permitted him to work but three hours a day. For these reasons only a favoured few were received into the family circle at Down, and the society even of these was rarely sought "because of the excitement, violent shivering, and vomiting thus brought on."

We quote from the chapter in the first volume, to which readers will turn with most interest, as containing the modest and candid autobiography which, without any thought that it would ever be published, Darwin wrote for his children when in his sixty-seventh year, "as if," he says at the outset, "I were a dead man in another world looking back at my own life." Next in interest to this is a characteristic paper by that "defender of the faith," Professor Huxley, who narrates, for the advantage of a generation which has grown up since the battle raged, the story of the reception of the "Origin of Species." Upon the preparation of this and Darwin's succeeding books the letters throw abundant light, and for this purpose Mr. Francis Darwin has wisely arranged them according to their several subjects. By far the larger number are addressed to Sir Joseph Hooker, whose fortunate prescience has preserved them from the commencement; and next in importance are those addressed to the late Sir Charles Lyell and to Professor Huxley. Both in the nature of its contents and in the simple, lovable, truth-seeking character which it exhibits, as of one to whom affection was dearer than fame, a more delightful and abidingly valuable collection has never been made public.

Darwin came of a long line of Lincolnshire yeomen, whose forbears spelt the name variously, as Darwen, Derwent, Darwynne, perhaps deriving it from rivers of kindred name. His father was a kindly, prosperous Shrewsbury doctor, son of Erasmus Darwin, also a doctor, and the celebrated author of "Zoonomia," the "Botanic Garden," and other florid and fantastic productions, in which, however, an accurate scientific presentment of certain facts of development is embodied. Beyond reminding our readers that his famous grandson was born at Shrewsbury in February 1809, educated at the Grammar School there, then at Edinburgh and Cambridge Universities; occupied as volunteer naturalist on board the *Beagle* from December 1831 till October 1836; that he published the "Origin of Species" in 1859, and was laid to rest in April 1882 near the grave of Newton in our beautiful Abbey of Westminster, we shall skip further oft-told detail, and, for the benefit of those to whom these portly volumes, the price of which is six-and-thirty shillings, may not be within reach, deal with some of the fresh matter which they contain, and the authority for which is mainly vouched for in Darwin's own words.

As with not a few other men of light and leading, neither school nor university did much for him, nor did his boyhood give indication of future greatness. In his answers to the series of questions addressed to various scientific men in 1873 by his cousin, Francis Galton, he says: "I consider that all I have learnt of any value has been self-taught," and he adds that his education fostered no methods of observation or reasoning. Of the Shrewsbury Grammar School, where, after the death of his mother in his ninth year, he was placed as a boarder till he was sixteen years old, he tells us "nothing could have been worse for the development of my mind;" all that he was taught were the classics, and a little ancient geography and history no mathematics, and no modern languages. And this is the abortion which still does duty for "education" in five-sixths of the schools of England, where the mechanical curriculum has no relation to the duties of after life. Happily for Darwin, he had inherited a taste for natural history and for collecting, his spoils including not only shells and plants, but also coins and seals. When the fact that he helped his brother in chemical experiments became known to Dr. Butler, that desiccated pedagogue publicly rebuked him "for wasting time on such useless subjects." His father, angry at finding that he was doing no good at school,

reproved him for caring for nothing but shooting, dogs, and rat catching, and declared that he would be a disgrace to the family! He sent him to Edinburgh University with his brother to study medicine, but Darwin found the dulness of the lectures intolerable, and the sight of blood sickened him, as it did his father. Although the effect of the "incredibly" dry lectures on geology made him—the future Secretary of the Geological Society!—vow never to read a book on the science, or in any way study it, his interest in biological subjects grew, and its firstfruits were shown in a paper read before the Plinian Society at Edinburgh in 1826, in which he reported his discovery that the so-called ova of *Flustra*, or the sea-mat, were larvæ.

But his father had to accept the fact that Darwin disliked the idea of being a doctor, and fearing that he would degenerate into an idle sporting man, proposed that he should become a clergyman! Darwin says upon this:—

I asked for some time to consider, as from what little I had heard or thought on the subject I had scruples about declaring my belief in all the dogmas of the Church of England, though otherwise I liked the thought of being a country clergyman. Accordingly I read with care "Pearson on the Creed," and a few other books on divinity; and, as I did not then in the least doubt the strict and literal truth of every word in the Bible, I soon persuaded myself that our creed must be fully accepted. Considering how fiercely I have been attacked by the orthodox, it seems ludicrous that I once intended to be a clergyman. Nor was this intention and my father's wish ever formally given up, but died a natural death when, on leaving Cambridge, I joined the *Beagle* as naturalist. If the phrenologists are to be trusted, I was well fitted in one respect to be a clergyman. A few years ago the secretaries of a German psychological society asked me earnestly by letter for a photograph of myself; and some time afterwards I received the proceedings of one of the meetings, in which it seemed that the shape of my head had been the subject of a public discussion, and one of the speakers declared that I had the bump of reverence developed enough for ten priests.

The result was that early in 1828 he went to Cambridge, the three years spent at which were "time wasted, as far as the academical studies were concerned." His passion for shooting and hunting led him into a sporting, card-playing, drinking company, but science was his redemption. No pursuit gave him so much pleasure as collecting beetles, of his zeal in which the following is an example: "One day, on tearing off some old bark, I saw two rare beetles, and seized one in each hand; then I saw a third and new kind, which I could not bear to lose, so I popped the one which I held in my right hand into my mouth. Alas! it ejected some intensely acrid fluid, which burnt my tongue so that I was forced to spit the beetle out, which was lost, as was the third one."

Darwin scarcely does his *Alma Mater* justice, for, happily for his future career, and therefore for the interests of science, he became intimate with men like Whewell, Henslow, and Sedgwick, while the reading of Humboldt's "Personal Narrative," and of Sir John Herschel's "Introduction to Natural Philosophy," stirred up in him "a burning zeal to add even the most humble contribution to the noble structure of Natural Science." The vow to eschew geology was quickly broken when he came under the spell of Sedgwick's influence, but it was the friendship of Henslow that determined his after career, and prevented him from becoming the "Rev. Charles Darwin." For on his return from a geological tour in Wales with Sedgwick he found a letter from Henslow awaiting him, the purport of which is in the following extract:—

"I have been asked by Peacock (Lowndean Professor of Astronomy at Cambridge) to recommend him a naturalist as companion to Captain Fitz-Roy, employed by Government to survey the southern extremity of America. I have stated that I consider you to be the best-qualified person I know of who is likely to undertake such a situation."

In connection with this the following memorandum from Darwin's pocket-book of 1831 is of interest:—"Returned to Shrewsbury at end of August. Refused offer of voyage."

This refusal was given at the instance of his father, who objected to the scheme as "wild and unsettling, and as disreputable to his character as a clergyman"; but he soon yielded on the advice of his brother-in-law, Josiah Wedgwood, and on Darwin's plea that he "should be deuced clever to spend more than his allowance whilst on board the *Beagle*." On this his father answered with a smile. "But they tell me you are very clever." It is amusing to find that Darwin narrowly escaped being rejected by Fitz-Roy, who, as a disciple of Lavater, doubted whether a man with such a nose as Darwin's "could possess sufficient energy and determination for the voyage."

With the details of that voyage, the one memorable event in Darwin's otherwise unadventurous life, our readers are surely familiar, for they are set down in delightful narrative in his "Naturalist's Voyage Round the World," and it will suffice to quote a passage from the autobiography bearing on the significance of the materials collected during his five years' absence.

During the voyage of the *Beagle* I had been deeply impressed by discovering in the Pampean formation great fossil animals covered with armour like that on the existing armadillos; secondly, by the manner in which closely allied animals replace one another in proceeding southwards over the continent; and thirdly, by the South American character of most of the productions of the Galapagos Archipelago, and more especially by the manner in which they differ slightly on each island of the group, none of the islands appearing to be very ancient in a geological sense. It was evident that such facts as these, as well as many others, could only be explained on the supposition that species gradually became modified; and the subject haunted me. But it was equally evident that "none of the evolutionary theories then current in the scientific world" could account for the innumerable cases in which organisms of every kind are beautifully adapted to their habits of life. . . . I had always been much struck by such adaptations, and until these could be explained, it seemed to me almost useless to endeavour to prove by indirect evidence that species have been modified. . . . In October 1838, that is, fifteen months after I had begun my systematic inquiry, I happened to read for amusement "Malthus on Population," and being well prepared to appreciate the struggle for existence which everywhere goes on, from long-continued observations of the habits of plants and animals, it at once struck me that under these circumstances favourable variations would tend to be preserved, and unfavourable ones destroyed. The result of this would be the formation of new species.

Shortly after his return he settled in London, prepared his journal and manuscripts of observations for publication, and opened, he says under date of July 1837, "my first note-book for facts in relation to the origin of species, about which I had long reflected, and never ceased working for the next twenty years." He acted for two years as one of the honorary secretaries of the Geological Society, which brought him into close relations with Lyell, and as his health allowed him to go into society he saw a good deal of prominent literary and scientific contemporaries, among these, Herschel, Carlyle, Macaulay, Buckle, and Sydney Smith. His reminiscences of these were evidently vague, of no one of them does he attempt any full-length portrait; clearly they were not in "touch" with him. He quotes an amusing story, which was told by Sydney Smith at Dean Milman's, of the penurious Lady Cork, who was once so much affected by one of the witty Canon's charity sermons that she *borrowed* a guinea from a friend to put in the plate. He has most to say about the fellow-dyspeptic who empties big buckets of contempt on a theory which he had never the patience to study, and who has only words of superior pity for the poor creatures who wade through the "Origin of Species," of which he says he could never read a line.

The last man whom I will mention is Carlyle, seen by me several times at my brother's house, and two or three times at my own

house. His talk was very racy and interesting, just like his writings, but he sometimes went on too long on the same subject. I remember a funny dinner at my brother's, where, amongst a few others, were Babbage and Lyell, both of whom liked to talk. Carlyle, however, silenced everyone by haranguing during the whole dinner on the advantages of silence. After dinner Babbage, in his grimmest manner, thanked Carlyle for his very interesting lecture on silence.

Carlyle sneered at almost everyone: one day in my house he called Grote's "History" a "fetid quagmire, with nothing spiritual about it." I always thought, until his "Reminiscences" appeared, that his sneers were partly jokes, but this now seems rather doubtful. His expression was that of a depressed, almost despondent, yet benevolent, man; and it is notorious how heartily he laughed. I believe that his benevolence was real, though stained by not a little jealousy. No one can doubt about his extraordinary power of drawing pictures of things and men—far more vivid, as it appears to me, than any drawn by Macaulay. Whether his pictures of men were true ones is another question.

He has been all-powerful in impressing some grand moral truths on the minds of men. On the other hand, his views about slavery were revolting. In his eyes might was right. His mind seemed to me a very narrow one; even if all branches of science, which he despised, are excluded. It is astonishing to me that Kingsley should have spoken of him as a man well fitted to advance science. He laughed to scorn the idea that a mathematician, such as Whewell, could judge, as I maintained he could, of Goethe's views on light. He thought it a most ridiculous thing that anyone should care whether a glacier moved a little quicker or a little slower, or moved at all. As far as I could judge, I never met a man with a mind so ill-adapted for scientific research.

In the autumn of 1842, two years and eight months after his marriage with his first cousin, Emma Wedgwood, Darwin removed from London, the air and social demands of which were alike unsuited to his health, and finally fixed upon a house in the secluded village of Down, near Beckenham, where he spent the rest of his days. Henceforth the life of Darwin is merged in the books in which, from time to time, he gave the result of his long years of patient observation and inquiry, from the epoch-making "Origin" to the monograph on earthworms. With bad health, apparently due to gouty tendencies aggravated by chronic sea-sickness during his voyage; with nights that never gave unbroken sleep, and days that were never passed without prostrating pain, he might well have felt justified in doing nothing whatever. But he was saved from the accursed monotony of a wealthy invalid's life by his insatiate delight in searching for that solution of the problem of the mutability of species which time would not fail to bring. In this, he tells us, he forgot his "daily discomfort," and thus was delivered from morbid introspection.

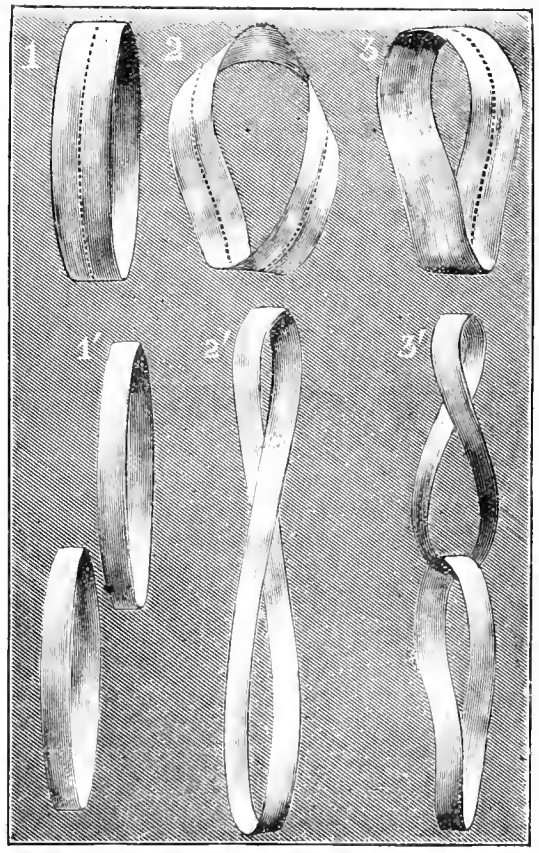
Before dealing with the circumstances which hastened the publication of the "Origin of Species," and with the influence of that book on belief in the supernatural, we may briefly describe some aspects of the man himself, as presented in Mr. Francis Darwin's chapter on the family life at Down.

The dome-like forehead with thick bushy eyebrows, the Socrates-like features, the figure wrapped in loose cloak, with broad-brimmed felt hat in hand, are familiar to us through photographs. But these do not tell us that he was six feet in height, of stooping posture, with eyes bluish-grey, and ruddy complexion which gave no sign of the discomfort from which he was never wholly free. His laugh had an honest and sounding ring, he overflowed with geniality that no pain could unsweeten, he was a devoted father—the touching record of the little maiden whom he lost, and on whose tomb he inscribed the simple words, "A dear, good child," evidence the tenderness of the man—he was fond of animals, courteous even to the more inferior species, known as bores; careful in money matters, extending this to the small concerns of the village Friendly Club; he betrayed an anxiety, strange in a man of his wealth, about leaving his children a competency; there was a curious side of penuriousness in his economy of paper, from the backs of old MSS. to the fragments of spills. He took snuff when he worked, and smoked when he rested, glad, after the more serious tasks and correspondence of the day were over, to listen to novels, for which he had a great love so long as they ended happily and contained "some person whom one can thoroughly love, if a pretty woman, so much the better." Strangely enough, he lost all pleasure in music, art, and poetry after thirty. When at school he enjoyed Thomson, Byron, and Scott; Shelley gave him intense delight, and he was fond of Shakespeare, especially the historical plays: but in his old age he found him "so intolerably dull that it nauseated me."

This curious and lamentable loss of the higher æsthetic tastes is all the odder, as books on history, biographies, and travels (independently of any scientific facts which they may contain), and essays on all sorts of subjects, interest me as much as ever they did. My mind seems to have become a kind of machine for grinding general laws out of large collections of facts, but why this should have caused the atrophy of that part of the brain alone on which the higher tastes depend I cannot conceive. A man with a mind more highly organised or better constituted than mine would not, I suppose, have thus suffered; and, if I had to live my life again, I would have made a rule to read some poetry and listen to some music at least once every week, for perhaps the parts of my brain now atrophied would thus have been kept active through use. The loss of these tastes is a loss of happiness, and may possibly be injurious to the intellect, and more probably to the moral character, by enfeebling the emotional part of our nature.

TRICK WITH PAPER RINGS.

THE annexed engraving from *La Nature* shows the method of preparing paper rings for the performance of a curious experiment. Take three strips of paper, 2 inches in width by from 2 to 5 feet in length, and with



one of them form a ring, as shown in fig. 1, by pasting the two ends together. Before pasting the ends of the

second ring, give the paper a single twist (fig. 2), and before completing the third ring give the strip two twists. These twists in the completed rings (1 and 2) will be so much the less perceptible in proportion as their diameter is greater.

If we take a pair of scissors and cut through the circumference of ring No. 1 in the direction shown by the dotted lines, we shall obtain two rings, as shown in No. 1'. Proceeding in the same way with ring No. 2, we shall obtain a single elongated ring, as shown in No. 2', and with No. 3, two rings which are connected like the links of a chain, as shown in No. 3'.

Reviews.

Factors in Life. By H. G. Seeley, F.R.S. (Society for Promoting Christian Knowledge.)—This work consists of three lectures upon the important subjects of health, food, and education. We have no hesitation in saying that it is a book that will do good wherever it is read. The thoughtful will find matter for more thought, and those who do not habitually think on these essential matters may, and probably will, find facts so strikingly placed before them as to impress them to their advantage. The language is rather above our artisans, but we should like to see it in their hands. It would make an excellent reader, for instance, in the higher classes in Board schools, or a capital little volume for cheap school prizes.

Manual of Zoology. By H. Alleyne Nicholson. (Wm. Blackwood & Sons.)—This book carries its own credentials in the imprint "seventh edition" on its title-page. But it is an edition which, keeping in step with the quick march of biological science, has been re-cast and re-written, so that it claims to be regarded as essentially a new work, and in comparing it with its immediate predecessors we find this claim warranted. The author's leanings to some fundamental difference between the inorganic and the organic are still apparent; but his treatment of the question is eminently fair, and his observations on the vulnerable part of the theory of natural selection have a force which Darwin himself never underrated, and which gives Professor Nicholson occasion to refer to Mr. Romanes's moribund theory of physiological selection. The *exposé* of the Duke of Argyll's baseless charge of *suppressio veri* against biologists in the matter of Mr. Murray's revision of Darwin's theory of the formation of coral reefs, which Professor Huxley gives in the November number of the *Nineteenth Century*, has further illustration in Professor Nicholson's reference. We observe that, in accordance with the best authorities, the author removes the sponges from the lowest sub-kingdom and promotes them to a sub-kingdom between the Protozoa and Celenterata, called the Porifera. We hope that the sponges duly appreciate this recognition of their nearer kinship with man. Altogether, the volume is to be accorded high rank as a complete and accurate, yet, having regard to its subject, not unwieldy, text-book. It is profusely illustrated with excellent woodcuts.

Sketch of Geological History. By Edward Hull, F.R.S. (C. W. Deacon & Co.)—The Director-General of the Geological Survey of Ireland follows illustrious examples in preparing this abstract of a science which he has at his fingers' ends. But, except as rounding off the series of historical manuals which the same publishers have issued, we fail to see the general object of the book. It is an attempt to compress a vast subject into an absurdly small space, with the result that the book reads like an enlarged index, which may be found useful to readers intending to pursue the subject farther. Dr. Hull has certainly no breath of genius in his style, whereby these dry bones might live, while, as in no wise strengthening his authority, he inclines to some modified theory of special creations, which may partly account for his reference to the appearance of marsupials as "born out of due time." The truer explanation seems to be that these highly organised forms existed at far more remote epochs than their earliest-known remains indicate.

The Tshi-speaking Peoples of the Gold Coast. By Major A. B. Ellis. (Chapman & Hall.)—The whole of the forest tract lying between the Assini and Volta rivers on the Gold Coast is inhabited by negro tribes speaking dialects of one language, called the Tshi (pronounced Tchwi). The enfeebling climate is largely responsible for their generally low condition, sufficing evidence of its deadening effect on both mind and body being cited by Major Ellis in the relapse of the inhabitants of Liberia, who are the descendants of freed American negroes, into barbarism. But although the tribes whose beliefs and customs are vividly and skilfully described have, except where in contact with the European settlers on the coast, and then only slightly, not been affected by foreign intercourse, their social organisations show them to be far above the savage level. It is in their customs, made tyrannically binding by connections with duties to the several orders of gods—tribal, local, family, and individual or tutelary—and in their crude ideas of death as unnatural, of the reality of dreams, of the ascription of life to every moving thing, and so forth, that the proofs of their unprogressiveness are found, and it is the details concerning these which make Major Ellis's book one of great value to the anthropologist, while it abounds in interesting matter for the non-specialist. Although the author explains totemism on Mr. Herbert Spencer's theory that an ancestor was once called by the name of an animal or plant, and that in the course of time his descendants, ignorant of the origin of a name, came to believe that he was descended from one or the other, and therefore abstained from them as food; and although he appears to accept Mr. Max Müller's explanations of fetichism as the corruption of a primitive faculty whereby man apprehends God, we find his information valuable and trustworthy, because he sees the difficulty of getting at facts free from the distorting media, fond delusions, and preconceptions of many travellers. It is a great gain to have such a book from so acute and dispassionate an observer as Major Ellis, and we hope that the reception which will be accorded to it may stimulate him to continue this important work of adding to our stock of knowledge concerning the ideas and practices of races whose extinction is only a question of time.

Animals from the Life. By Heinrich Leutemann. Edited by Arabella B. Buckley. (Edward Stanford.)—We must accord this charming and delightful book the first place among worthy gifts for our young folk this season. Miss Buckley has adapted the German original—the distinctive and careful feature of which is in its actual studies from the life—to the requirements of English children, for whom she describes, in her own accurate and easy style, the animals grouped on each plate. They are given in descending scale, from man to sponge, and dull must the child be in whom these beautifully-coloured pictures do not awaken interest in all that lives.

From a Garret. By May Kendall. (Longmans.)—"That Very Mab" gave ample proof of Miss Kendall's cultivated intellectual gifts, and "that very" clever book led us to expect some less fugitive work from her brilliant, and often caustic, pen than the present collection of studies. The device of a prologue, which purports to edit somebody else's manuscript, is a trifle stale, and neither awakens nor enhances interest in characters that play a more or less real

part in these slight sketches. Most vivid among these are the tramcar man, who could only get time to be married before the registrar while the horses were being changed; most touching the story of Sally, the lodging-house slavey. Some of the others, as the chemist and the bumptious mathematical girl, are but lay figures upon which the remnants of barren controversies are hung. No one who begins the book will lay it down until the epilogue is reached; but Miss Kendall should send out no more scouts and stragglers, and prove herself as capable as we believe her to be of a sustained and serious effort.

We say this the more emphatically after reading her dainty little volume of poems, *Dreams to Sell* (same publishers), which her friend "A. L." introduces in charming stanzas as songs that "please him well." They are worthy of the praise of so accomplished a critic and poet; delightful is the echo of Matthew Arnold's "Forsaken Merman," which "The Mermaid's Chapel" awakens; and the "Ballad of the Cadger" will be welcome to the lovers of Austin Dobson's "Child Musician." But Miss Kendall must get her evolutionary lays revised by experts, who will correct her removal of Trilobites from the Crustacea to the Arachnida, and of the Monotremes from pond and marshy burrows to the "silent sea."

Health Maps. By ANNA T. ARNIM. (Swan Sonnenschein.)—This work is issued in five neat and portable parts or "groups," each being prefaced with a clear and crisp introduction, and filled with a distinct set of exercises adapted to stimulate and strengthen a given set of muscles. Each exercise is illustrated by a diagram, a description of the particular movement, and a note specifying in which muscles of the body the movements should be felt. The "groups" form a complete manual of instruction by which even unskilled teachers may quickly train themselves to give many of the lessons.

Equally worthy of commendation as well adapted for its purpose, is *The Teacher's Manual of Drill*, by MARY E. HUDSON (Griffith, Farran, & Co.). The practical directions are given with admirable simplicity, and so varied as to cause the minimum of fatigue to children.

Handy Volume Atlas of the British Empire. (Geo. Philip & Son.)—This neat and compact little book is a companion volume to the publishers' "Handy Volume Atlas of the World." In the space of 6 by 3 inches there are packed 120 maps and plans of exquisite clearness, supplemented by an index of 10,000 place names, and interleaved with geographical and historical notes. It is a marvel of excellence in rare combination with cheapness, for the published price is only 3s. 6d.

Posthumous Humanity. By ADOLPHE D'ASSIER. Translated and Annotated by HENRY S. OLCOTT. (London: George Redway. 1887.)—There is something particularly sad in the history of this collection of hopeless trash. Blind and partly paralysed, its unfortunate author has listened to and gravely recorded as fact a series of the veriest "cock and bull" stories it was ever our misfortune to be compelled to wade through. His book is a mere *réchauffé* of second, third, fourth, and so on to *n*th, hand legends, many of them mediæval, and the vast majority, in popular parlance, "as old as the hills." Haunted houses, witchcraft, wehrwolves, lycanthropy, vampires, and so on, and so forth, are all accepted by poor M. d'Assier as being as undeniable as sun-rise. If these lines were ever likely to be read to him in the only language which he apparently understands, we would urge him to read the account of the "Stockwell Ghost," in vol. i. of Hone's "Everyday Book," whence he would learn how missiles were thrown, cups, plates, and saucers dashed about, a pail of water set boiling, &c., in broad daylight in the presence of scores of people, and how the maid-servant, Ann Robinson, subsequently confessed in detail how she herself performed every one of these miracles. He might, perchance, detect the intimate resemblance of the Stockwell phenomena to those which he himself narrates. Colonel Olcott's notes are beneath contempt. Two illustrations of this must suffice. On page xv. of the Introduction he quotes Professor Hare as having verified "the reality of mediumistic phenomena," studiously suppressing the fact that Mr. Hare was insane—in fact, died in a lunatic asylum. Again, on page 180, he speaks of Mr. Crooke photographing materialised spirits "by the electric light in his own laboratory," as studiously concealing the fact that the "spirit" thus photographed was Miss Florrie Cook, subsequently detected, *flagrante delicto*, and exposed, by Sir George Sitwell and Herr von Buch. Sometimes, though, the author is too credulous even for Mr. Olcott, *vide* footnotes on pages 121, 197, &c. A more piteous literary exhibition than the entire volume has rarely come under our notice. There is not one scrap or atom of evidence in it on which any magistrate would dare to send the veriest tramp to gaol for a week's hard labour.

Claverhouse. By MOWBRAY MORRIS. (London: Longmans, Green, & Co. 1887.)—Here is another attempt to rehabilitate a man to whom history—or rather, perhaps, tradition—has not been too kind; and, as it seems to us, in this case considerable success has attended the efforts of his latest biographer. Whatever virtues the Covenanters may have possessed, truthfulness in connection with those opposed to them was very far indeed from being one of the most conspicuous; and hence the legends of Claverhouse's ferocity which appear in the pages of chroniclers like Wodrow must be taken with a very large grain of salt indeed. It must be carefully borne in mind that "Bonnie Dundee" lived in an age which was essentially rough and brutal, when the refinements of modern warfare were unheard and undreamt of, and when, for example, anything like a joint undertaking on the part of nations to limit the size or description of their service projectiles would have been scouted as the wildest nonsense. When, then, Claverhouse was sent out to suppress what amounted to an open rebellion against his sovereign, he employed the tactics of his day, which were no more of the rose-water school than those of the insurgents themselves. That, however, he was the malignant, bloodthirsty scourge which the old Covenanters represented him to be, Mr. Mowbray Morris has clearly disproved in the very interesting and readable volume before us.

The Ambulance Pupil. By A PUPIL OF THE ST. JOHN AMBULANCE ASSOCIATION. (London: Crosby Lockwood & Co. 1887.)—This tiny pocket volume should be in the possession of everyone who is ever likely to be present at an accident, either to himself in person or to others; as the simple directions may, if followed out, be the means of saving many a precious life.

Specific Unbelief: England's Greatest Sin. By ANDREW SIMON LAMB. (London: James Nisbet & Co. 1887.)—It is much to be desired that Mr. Lamb should read, mark, learn, and inwardly digest the whole of the third part of "The Problem of Evil," by Daniel Greenleaf Thompson. He simply reiterates what may be heard next Sunday in any "Little Bethel" in the kingdom, being obviously an "Evangelical" of the narrowest type. We should be curious to know how he would attempt to connect the deaths of the flint-folk, who lived and died 20, 50, or even 100,000 years ago, in their caves, with the transgression of the "first man," Adam. Had Mr. Chadband been rather better educated, he might well have written this little book.

VENUS AS A MORNING STAR.

It seems impossible to imagine that the numerous correspondents who have descended upon us with a flood of more or less nonsensical questions about "The Star of Bethlehem" can ever look at the column headed "The Face of the Sky," which appears in every monthly part of this magazine. Reference to that column for November and December will show that its writer specifically speaks of Venus as "a brilliant object to the south of east about 3 A.M.," and as "a most brilliant and conspicuous object in the south-east before sunrise"; but, ignoring this, a number of persons who are, or profess to be, readers of KNOWLEDGE, have inundated us with queries as to whether a new variable or periodical star has become visible? whether the Star of Bethlehem has reappeared? whether it is the one that appeared to the Wise Men?—(in which category this particular querist as modestly as properly omits to include himself) whether the original apparition (Matthew ii. 2, 9, and 10) was miraculous or not? and so on. Once for all, then, the star which has recently shone so gloriously in the morning sky is Venus, and nothing else in the world. She goes round the sun inside of the earth's orbit in about 224¾ days, and if the earth were stationary would, at the end of that period, come approximately into the same position in our (then) fixed sky. But, as every one knows, the earth herself revolves round the sun in something like 365¼ days, and hence Venus does not return to the same phase until after a lapse of 584 days—*i.e.* in one year, seven months, and about a week. Hence it will be seen that what we have been viewing is simply a recurrence of what happened during the early mornings in December 1885 and January 1886. Venus is now travelling away from the earth, and on July 11 will be behind the sun. Pursuing her path, she will emerge from his rays and reappear to the east of him, after which she will become an evening star, and in February and March 1889 will be as striking an object after sunset as she recently has been before sunrise. About Lady Day in that year she will be distinctly visible to the naked eye (of any one who knows precisely where to look for her) in bright sunshine. The Star of Bethlehem of Matthew's gospel—if it ever really existed and is not the mere embodiment of a myth—must in all probability have been a comet.

THE FACE OF THE SKY FOR JANUARY 1888.

THE sun presents but few features of interest for observers under existing circumstances, although one fine group of spots appeared last month upon his disc. The night sky is delineated on map i. of "The Stars in their Seasons." Minima of Algol ("The Stars in their Seasons," map xii.) will occur on Jan. 3 at 6h. 55m. P.M.; on the 20th, at 11h. 18m. P.M.; on the 23rd, at 8h. 37m. P.M.; and on the 26th, at 5h. 26m. P.M., as well as on other occasions inconvenient to the amateur observer. Mercury is a morning star up to the 14th, but subsequently souths after the sun. His great south declination, however, renders him practically invisible throughout the month. Venus is a morning star throughout January, and is very nearly as badly placed for the observer as Mercury. Mars does not rise until after midnight at the beginning of the year, and a little before 11h. 30m. P.M. by January 31. Moreover, he only looks like a large red star, and detail on his surface is quite beyond the power of ordinary telescopes. Jupiter is a morning star, and very badly placed to boot. In fact, Saturn is now the only striking object in the night sky. Starting from a point almost on a line joining γ and θ Cancri ("The Stars in their Seasons," map iii.), he will travel in a westerly and northerly direction. The closing up of his ring system since his opposition in 1885–86 is now very perceptible. Titan, his brightest satellite, will be at its greatest elongation east of him (between 11 and 12 diameters of the planet) at 3h. A.M. on Jan. 12; and at midnight on the 27th. Uranus is, for our present purpose, invisible, and Neptune is very much where we left him last month. The moon enters her last quarter at 11h. 42·6m. A.M. on the 6th, is new at 8h. 38·7m. on the morning of the 13th, enters her first quarter at 4h. 49·3m. A.M. on the 21st, and is full at 11h. 18·9m. on the night of the 28th. There will be a total eclipse of the moon on this night (that of the 28th), visible in this country, the leading details of which we subjoin in a tabular form:—

	H.	M.		
First contact with the penumbra	8	29·0	P.M.	Greenwich mean time.
First contact with the shadow	9	30·5	,,	
Beginning of total phase	10	31·1	,,	
Middle of the eclipse	11	20·1	,,	
End of total phase	12	9·1	,,	
Last contact with the shadow	1	9·7	A.M.	
Last contact with the penumbra	2	11·2	,,	

If we call the moon's diameter 1, she will be immersed 1·643 of that diameter in the earth's shadow at the time of the middle of the eclipse. Measuring from the northernmost point of the moon's limb towards the east, the first contact with the shadow will take place 93° from such north point, and the last contact at 74° towards the west. This is as seen with the naked eye, not as viewed in an inverting telescope. Only three occultations of fixed stars by the moon will happen this month at all at convenient hours. The first happens on the 25th, when χ^3 Orionis, a star of the 6th magnitude, will disappear at the moon's dark limb, at 36 minutes after midnight, at an angle from her vertex of 178°, reappearing at 1h. 20m. the next morning at a vertical angle of 258°. Then, on the 29th, 7 Leonis, a 6½ magnitude star, will disappear at the moon's bright limb, at 5h. 41m. P.M., at an angle of 332° from her vertex, and reappear at her dark limb at 5h. 55m. P.M. at an angle from her vertex of 298°. And, lastly, on the same evening ψ Leonis, of the 6th magnitude, will disappear at the bright limb of the moon, at 9h. 13m., at a vertical angle of 320°, reappearing at her dark limb, at 9h. 24m. P.M., at an angle of 300° from her vertex. These last two reappearances will happen very near to the illuminated part of the moon. The beginning of the new year finds the moon in Cancer, which, at 5h. A.M. on January 22, she quits for Leo ("The Seasons Pictured," plate xxiv.). She is travelling through Leo until 7h. P.M. on the 4th, at which hour she enters Virgo ("The Seasons Pictured," plate xxv.). Her journey through Virgo occupies her until 9h. 30m. P.M. on the 7th, and she then crosses the boundary into Libra ("The Seasons Pictured," plate xxvi.). As she travels over Libra, she arrives, at 2h. 30m. P.M. on the 9th, at the western edge of the narrow northern spike of Scorpio, and when 9 hours later she has traversed this, it is to emerge in Ophiuchus. At 1 P.M. on the 11th she leaves Ophiuchus and enters Sagittarius. Here she continues until 7h. 30m. P.M. on the 13th, then quitting Sagittarius for Capricornus ("The Seasons Pictured," plate xxi.). Her passage through Capricornus is completed at 7h. P.M. on the 15th, and she then passes into Aquarius. Here she remains until 10h. P.M. on the 17th, passing at that hour into Pisces ("The Seasons Pictured," plate xxii.). Journeying through Pisces, she, at 6h. P.M. on the 18th, arrives on the confines of Cetus, into which she plunges. From this she emerges at 1h. A.M. on the 20th, and re-enters Pisces; only, however, to pass for a second time into Cetus at 2h. A.M. on the 21st: when at 8 o'clock that night she finally leaves Cetus it is to pass into Aries ("The Seasons Pictured," plate xxiii.). She is travelling through Aries until 9h. P.M. on the 22nd, when she enters Taurus. In the course of her passage over Taurus she comes at 6h. 30m. P.M. on the 25th to the western edge of the most northern prolongation of Orion. This it takes her eleven hours and a half to cross, and when at 6 o'clock the next morning she has traversed it, she emerges in Gemini ("The Seasons Pictured," plate xxiv.). She leaves Gemini for Cancer at 1h. A.M. on the 28th, and Cancer, in turn for Leo, at 1h. P.M. on the 29th. She is still in Leo at midnight on the 31st.

A QUICK CALCULATOR.—Reuben Fields, a most extraordinary individual, has returned to his home in Kentucky, after an absence of some years in the West. Fields is known far and wide as the "Mathematical Prodigy," and, indeed, he is a wonderful creature. Perfectly illiterate, not being able to tell one letter or figure from another, he bears the same relation to the science of mathematics that Blind Tom does to music. Fields is now about twenty-eight years of age, and his ability to quickly and correctly solve the most difficult problems was discovered when he was eight years old. That faculty continued to develop until he is able to solve, with amazing rapidity, any problem in simple or compound fractions, or anything in the higher branches of mathematics. For instance, the moon is a certain number of miles from the earth; a grain of corn is so long; how many grains will it take to connect the points? The answer to this or any other problem comes like a flash. He can also tell to a second the time of day or night! This marvellous man has been tested by the most expert mathematicians, and his answers to problems have been found to be invariably correct. He claims that his power is a direct gift from the Creator, and liable to be taken away from him if not properly used. The possessor of this gift never went to school a day in his life, and never did a day's work, except to occasionally aid merchants in invoicing their goods, and in this business he has been known to keep a score or more of clerks busy footing up columns of figures. He is a very large man, and has a look the reverse of intelligent. Having no occupation, he lives among his acquaintances, putting up wherever night overtakes him. He is very proud of his gift, and frequently compares himself to Samson. Fields gave an exhibition of his powers before Governor Crittenden and other distinguished men of Missouri on a late visit West, and they consider him one of the greatest wonders of the century.

Our Whist Column.

By "FIVE OF CLUBS."

THE DOG AND THE SHADOW.

If you will not when you may,
When you will you shall have nay.—OLD PROVERB.

I WAS a looker-on, a few months ago (down in Florida), at a game of whist which illustrated charmingly the folly of the two commonest mistakes of the unscientific whist-player—(1) the idea that the fall of two trumps for one is bad for those who played them, where one of these has held a considerable strength: and (2) the notion that a ruff is always a gain for the ruffer.

I had been told to watch the play of an old gentleman whom we will call A (his partner being B); but I quickly found that his opponent on the left (Y), a comparatively young man, and a stranger to the rest of the company, was a much better player; while Z, the fourth player, though weak so far as original play was concerned, had none of that fatal cleverness which injures the game of those who trust wholly in their own ideas and will learn nothing from the stored experience of tens of thousands of players and a century and a half of play.

In the particular game which interested me most among those I watched, A had a long suit of diamonds, which he was lucky in seeing established in two rounds, leaving him four long diamonds, all small but all (as he perfectly well knew) as good as trumps (hearts) when trumps should be out. At the first opportunity A very properly led trumps (having four, headed by the king), and after three rounds, Z having had but one trump, A remained with king of trumps, B holding the queen, and Y a small one, obviously to all the table. Also, A held a small club, a suit of which his partner was void.

At this stage A had a choice between two good lines of play. His plainest course was to draw out the remaining trumps and make the four small diamonds; five tricks off the reel—which, with three made before, would give A-B two by tricks. The best course, however, was to force Y with a diamond, when, if Y yielded to the force, A could make his king trump by ruffing, then his three small diamonds, and finally give B a ruff, who might, as far as A could tell, be then able to make the last trick, in which case A-B would make three by tricks; and in any case A-B could not make fewer than two by tricks on this line as on the other. So that this was the correct play, though as the cards lay nothing would have been gained by it.

But the first of these courses was most objectionable to A, because it involved the fall of two trumps, and the two best trumps at that, for one of the enemy's. This was contrary to A's ideas of sound whist play, and his every word and gesture showed that he held himself the soundest player there. The other course was not less objectionable to him, for it would enable Y to make his little trump by ruffing one of A's winning diamonds.

Manifestly, A considered the proper thing to play for was to let B make his trump separately, then to capture Y's, make the long diamonds, and so secure three by cards. It did not occur to him that this, though a very proper thing to be done, if it *could* be done, was not at all the right thing to play for if it could not possibly be managed. If B were thus given the opportunity of making his trump queen, he could not possibly give A a lead whereby to extract Y's small trump. The only lead he could give A would be by forcing him, when Y would remain with the last trump and winning cards (as it happened) in clubs and spades, not one of A's established diamonds being of the least use to him. Thus two more tricks only would be made instead of five, and A-B would lose the odd trick instead of making two or three by tricks.

As a matter of fact, B did not ruff the card A had led to him for the purpose. Whether he had some half-formed notion that the only chance now left for A to get in his diamonds lay in B's passing this trick, on the chance that Y, who had taken it (bar the ruff), would lead a trump to draw two for one, was not clear. My notion is that B simply declined to ruff Y's winning club, a ten only, because he thought the queen of trumps too good a card to be used for that purpose, for most of B's play had been unutterably weak. Be this as it may, B passed the trick. Y immediately began to lead out winning spades, forcing A (for B had plenty of the suit). Then A, having nothing better to do, led a diamond, Y ruffed, B overruffed: and B having only spades to lead to Y's strength in the suit, Y made all the remaining tricks. Thus Y-Z made on this line the odd trick, as they would had B ruffed at the outset. This sequel strengthens the illustration which the game afforded of the folly of the doctrine that it must be good to draw two trumps from the enemy for one, and bad to draw two trumps from your own side for one from the enemy. For had Y played this game A would have made all his long diamonds, and A-B would have made two by tricks.

A immediately explained to B what his object had been, adding, "How unfortunately it turned out!" He should have said, "How ill I played!" Y simply scored the odd trick and smiled. He evidently felt it was no part of his business to teach his opponents better play.

DOUBLE DUMMY PLAY AND A DOUBLE DUMMY PROBLEM.

It has been said by Mr. F. H. Lewis, one of the finest whist-players living, and beyond all doubt the most skilful composer of double dummy problems, that double dummy is the grammar of whist. Players who doubt the value of accuracy in whist conversation should play double dummy awhile. It will give them entirely new ideas. Skill tells more in this game than in any form of whist, especially when played, as it certainly should be, without counting honours. (To my mind there is something absurd in counting honours, which depend solely on chance, at this purely scientific game.) In the long run, the best player invariably wins at double dummy; and in my own experience I have found that where there is any marked disparity of skill, every sitting of an hour or so leaves the better player ahead, the cards never running so strongly to one side as to let the weaker gain the majority of points. In my lecturing tour in the South in the season 1885–6, I lightened many hours of railway travelling by double dummy play with a friend (and relative) who travelled with me. He had had less practice in whist play than I, and had studied the language of the game much less (which is a very different matter, by the way). Now, though the cards would often run so heavily against me that I would lose ten or twelve points in the course of half an hour or so, every sitting ended by placing me further ahead, and when our travels ended I was 191 points to the good (we were "playing for love"). In actual whist this would not happen. It was easy to see how the effect of correct play came in. With good cards success was more complete; with bad cards failure was less disastrous. Five times I scored every trick (being twice able to announce from the beginning that this would be the result), and many times against apparently overwhelming hands I lost only the odd trick, or even made the trick. All this shows what may be done by the proper conduct of the game; and play, by which inferences as to the position of various cards may be early formed, enables watchful partners to do to some degree what the double dummy player can effect.

Next to actual double dummy play in value as whist practice comes the study of double dummy problems. Here is a problem by Mr. Lewis (it is taken from the "Westminster Papers," I need hardly say), which will be found worth careful study. It is not difficult—at least for those who have had practice in double dummy play. Solvers should keep their solution for comparison with the analysis, which will shortly appear, as it is impossible for me, living as I do in Florida, to examine the various solutions:—

THE HANDS.

B { H. (*trumps*).—A, Kn, 8, 6, 5. C.—A, K, Kn, 4. S.—2. D.—A, 6, 4. }

Y { H. (*tps*).—Q, 10, 4. S.—Q. C.—Q, 10, 6, 5. D.—Q, 9, 8, 7, 5. }

B
Y Z
Tr. Hearts
A leads.

Z { H. (*tps*).—K, 7, 2. S—K, 10, 9, 8, 7. C.—9, 8, 7, 2. D.—Kn. }

A { H. (*trumps*).—9, 3. C.—3. S.—A, Kn, 6, 5, 4, 3. D.—K, 10, 3, 2. }

Hearts are trumps. A leads. How many tricks can A-B make against the best defence?

LOOSE MODEL BUILDING STONES, MANUFACTURED BY RICHTER & Co., and issued with books of instruction, showing how model arches, bridges, vaultwork, mosaic floors, and miniature houses can be constructed by very young people, may certainly be considered in the light of scientific toys of high order, and following, as they do, the form of ordinary bricks with decimal exactness, they afford opportunities of instruction to youthful minds in architecture and practical building. The fact of their being coloured tends to artistic training also. These stones or bricks can be advantageously adopted by the architect or builder for experimental purposes. We can, therefore, confidently recommend them to students of building and architecture, who would undoubtedly derive valuable assistance from them.

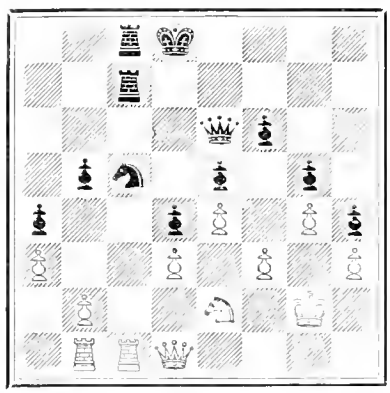
Our Chess Column.

By "MEPHISTO."

THE TOURNAMENT OF THE B.C.A.

ENDINGS FROM ACTUAL PLAY.

BLACK.



WHITE.

THIS is a curious example of a block. Everything seems to be equal, but in reality White's pieces are all doomed to inactivity. Black forces a win by playing Kt to Kt6 at the right time, thereby compelling the exchange of Rooks, obtaining possession of the Bishop's file, and playing R to B7. White may vary his play, but he is unable to save the game.

1. R to B3.

What White actually did was to move his King backwards and forwards. Any other move would have likewise resulted as indicated above, for instance—2. Q to Q7, Kt to Kt6. (This is also the reply to R to B2.) 3. R × R, Q × R. 4. Q to Kt4 (to avoid Q to B7, and to obtain a perpetual check). 4. Q to B4. 5. K to B2, Q × Q. 6. P × Q, R to B7. 7. K to K sq., R to K7. 8. Kt to B sq., R to R7, and Black will win.

2. K to Kt sq.	2. R(B sq.) to B2
3. K to Kt2	3. Q to B sq.
4. K to Kt sq.	4. K to Q2.

Intended to meet a possible incursion of the Queen into Black's game.

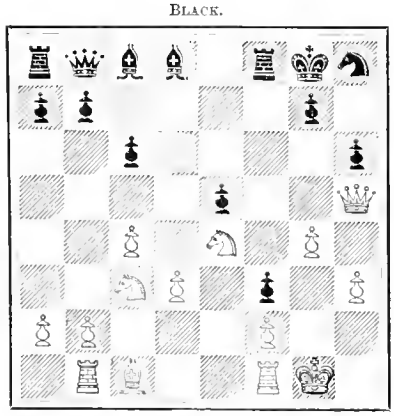
5. R to B2	5. Kt to Kt6

Of course Black would not at any time permit Kt to B sq.

6. R × R	6. R × R
7. Q to K sq	7. R to B7

and Black wins.

BLACK.



WHITE.

This is also a most singular position. Every one of Black's pieces has been withdrawn home, but all of them, although apparently awkwardly placed like the Queen and Knight, take part in the attack, and are ready to act, while, on the other hand, White, who seems to have the better development, is rather helpless, the White Queen being unable to move. A speedy termination in favour of Black seems somewhat surprising.

Black proceeded as follows:—

	1. B to Q2

(threatening B to K sq).

2P to Kt5	2. R to B2

A subtle move. If P × P, then P to Kt3 wins the Queen, or if P to Kt6, then R to B4 likewise wins the Queen.

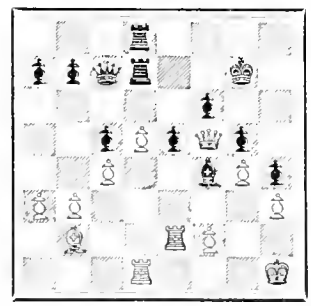
3. K to R2	

In the vain hope of being able to play R to Kt sq, Q to R4 was better.

	3. P × P
4. Kt × P	4. P to K5 (ch)
5. K to R sq	5. B × Kt
6. B × B	6. P to Kt3
7. Q to R4	7. R to R2
8. Q to B4	8. B × P
9. K to Kt sq	9. B to Kt7
Resigns.	

White lost time on his third and fifth move, but Black will maintain a winning attack against best play.

BLACK.



WHITE.

White played.	
1. R to K1	Q to Q3
2. R × B !	KtP × R
3. P to Kt5	K to B2
4. R to KKt sq	K to Q2
5. Q to R7 (ch)	K to K sq
6. Q to R5 (ch)	R to B2
7. P × P	Q × BP
8. R to Kt5 !	K to K2
9. B × P	Q to QKt3
10. R to Kt6	Resigns.

GAME PLAYED IN THE TOURNAMENT OF THE BRITISH CHESS ASSOCIATION.

(CENTRE GAMBIT.)

WHITE. J. Gunsberg.	BLACK. J. Mortimer.	WHITE. J. Gunsberg.	BLACK. J. Mortimer.
1. P to K4	P to K4	13. Kt to Kt5 (*c*)	P to Kt3
2. P to Q4	P × P	14. QKt to K4	P to B4 (*d*)
3. Q × P	QKt to B3	15. P to Kt4	P × Kt (*e*)
4. Q to B4 (*a*)	Kt to B3	16. P × Kt	QP × P
5. Kt to QB3	B to Kt5	17. RP × P	RP × P
6. B to Q2	P to Q3	18. B × B	Kt × B
7. Castles QR	P to QR3	19. Q × KP (*f*)	Kt × P (ch)
8. P to B4	Castles	20. K to Kt sq	B to B4 ?
9. Kt to B3	B to Q2	21. R × Q	B × Q
10. P to KR3	P to QKt4	22. R × R (ch)	R × R
11. Q to K2	R to K sq	23. Kt × B	Kt to Kt5
12. P to K5	Kt to KR4(*b*)	24. Kt to B6 (ch)	and wins.

NOTES.

(*a*) Having played the Queen, it is not very material where she goes to. On B1 the Q escapes attack more readily than on K3—at least for the present.

(*b*) A tempting move, but, as will be seen, it leads Black into complications.

(*c*) Preventing Black from playing Kt to Kt6, as then White would reply with Q to Q3, threatening mate.

(*d*) P to Q4 would have been better.

(*e*) Kt × BP should have been played.

(*f*) The game cannot be saved now. Q to K2 is useless.

CONTENTS OF No. 26.

TERMS OF SUBSCRIPTION.

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SCIENCE, LITERATURE, & ART

LONDON: FEBRUARY 1, 1888

THE STAR OF BETHLEHEM.

IF there is one feature of popular converse about astronomy which indicates more clearly than another the generally-prevalent ignorance of science, it is the absurd nonsense now so often heard respecting what is called "the Star of Bethlehem." I suppose that at least 2,000 letters must have been addressed to me with inquiries about this non-existent orb. Again and again I am gravely told that the Star of Bethlehem has already appeared, its place of appearance being at one time Yorkshire or Devonshire, in England, at another Algiers or Constantinople or Tobolsk, at another a village in Kentucky, at another in Buenos Ayres or Rio Janeiro.

There are certain times when the Star of Bethlehem is sure to be discovered somewhere or other. One of these brought with it "Professor" Klein's discovery in Kentucky last summer; another was distinguished by the discovery of the erratic star by a young lady in Texas last November.

Luckily, a year and a quarter must elapse before the same Star of Bethlehem is likely to be discovered—somewhere about March 25, 1889; then again after a few months, on or about June 6, we are likely to hear that some village professor or some young girl or some sky-contemplating local lunatic has seen the Star of Bethlehem: after which it will not be till the end of October, 1890, that the mystic orb will be noticed.

Napoleon Bonaparte was one of the discoverers of the Star of Bethlehem; but he made a better use of it than the young lady in Texas or the "professor" of Kentucky. He pointed to it as it shone faintly in the heavens by day, and, instead of displaying ignorance, he took advantage of the ignorance of his officers, saying, "That is *my* star!" probably knowing quite well that the orb at which he pointed was Venus, a world nearly as large as that for a small portion of whose surface he had stained that surface with the blood of myriads of men.

For all the announced apparitions of the Star of Bethlehem the Planet of Love has been responsible. She always can be seen in full daylight for a few days at the time of her greatest brilliancy. And, although it is nowhere stated in the Gospel record that the Star of Bethlehem was visible in the daytime, it seems somehow to be taken for granted that it did present and will again present this exceptional peculiarity. Yet, by the singular perversity of ignorance, the very persons who look for the Star of Bethlehem by day, proclaim their belief that it is the star which is called Tycho Brahe's—a star which shone out in 1572 in the constellation Cassiopeia, and which could be seen all through the night all the year round in all the countries and places whence people imagine they have seen the mystic orb. Tycho Brahe's star, the situation of which is perfectly well known, even if the very star has not (as is probable) been identified with a catalogued eighth-magnitude star (shown in my large northern chart of 324,198 stars), does not pass below the horizon of any place in higher latitude than 26½ deg. north. Whenever that star changes in brightness even by a single magnitude, astronomers will know of the change and may be trusted to attend to it; though not one among their number imagines for a moment that there is the remotest connection between that distant sun, probably at least a hundred years' light-journey from us, and the Star of Bethlehem.

The story of Tycho Brahe's star has been so often told, that I shall here say little on the subject, directing the reader's attention rather to the real story of the Star of the Nativity, as related by one who was probably not Matthew, since the Ebionites who accepted Matthew's as the only trustworthy Gospel rejected the story of the Nativity as a later addition, dating probably from about the year 110.

The history of Tycho Brahe's star differs in no important details from that of the equally brilliant temporary star known as Kepler's. It blazed out suddenly close by the star Kappa of Cassiopeia, the faintest of the four stars which mark the back of the Seated Lady's Chair. At first it was brighter than Venus at her brightest. This superiority was not due to the fact that the star was visible at night (whereas Venus is never seen on a dark sky), for the new star could be seen in the daytime. Probably, by-the-bye, it may be this peculiarity of Tycho Brahe's star which has led to the notion that whenever Venus is seen in the daytime the Star of Bethlehem has returned. But it speaks rather ill for the intelligence and information of the general public that because a star which has certainly nothing whatever to do with the Star of the Nativity, and which if visible now at all would show all night, was for a while visible in the daytime, therefore another orb which is not a star at all, and which returns periodically to daylight visibility, should be taken for that orb, although the place of Tycho Brahe's star shows in the night time no star even of the sixth or seventh magnitude.*

The statement that Tycho Brahe's star has been identified with two stars which shone out respectively in the years 945 and 1264 is far from justified by the evidence. On hunting over old records, two were found which very doubtfully suggested that celestial objects which might have been stars, but might also have been comets, had been seen in the years 945 and 1264, either of which might have appeared where Tycho Brahe's star was seen, or, on the contrary, might have been anywhere within a distance of 10 or 12 degrees from it. Of course, if these were merely apparitions of Tycho Brahe's star, which I regard as wildly improbable, then since an interval of 319 years elapsed between their appearance, and an interval of 308 years only between the later of the two and Tycho Brahe's star, it is evident the variable is not regular in its returns. And since 315 years have already passed since Tycho Brahe's star was seen, the prospect of a return of the star to visibility is somewhat doubtful, apart from the more than doubtful character of the evidence on which the identity of the stars or orbs of 945, 1264, and 1572 has been based. If, however, it should happen, as it very well may, that Tycho Brahe's star should blaze out within the next few years, the general

* An attempt was made to save the Texan Star of Bethlehem from detection as an impostor last October by announcing that though it had been visible for several days it had vanished, so that astronomers need not hope to persuade the world that it had not really appeared. But, unfortunately, that self-same supposed star was blazing out morning after morning as Venus, the Morning Star, while night after night, all that time, the place of Tycho Brahe's star was absolutely vacant so far as naked-eye vision was concerned, and occupied only for telescopic vision by an eighth magnitude star.

public may rest confidently assured that its apparition will be in no way connected with the star described in the Gospel of Matthew.

As to that record itself, it is singular that any doubt should exist as to its meaning.

That the story relates to an astronomical event is of course certain. Had some meteorological phenomenon been in question the narrative would unquestionably have been otherwise worded. The event was certainly astronomical; the magi were certainly astronomers. Saying this is in effect saying that the magi were astrologers, and that the event was chiefly interesting in its astrological aspect. Farrar and Geikie in their lives of Christ follow all theologians of any weight who have ever dealt with the narrative of the Nativity in admitting this.

But theologians seem to be unconscious, one and all, of the overwhelming difficulty in which this interpretation lands them. We find them placidly discussing the widespread belief in astrological ideas and in the supposed influence of the heavenly bodies on the affairs and fortunes of the human race—not as if they were striving to get rid of a great difficulty, but as if the discussion were part of the explanation of the Star of Bethlehem. Not once, so far as my own reading extends (and this subject has been one about which I have read much) does any theologian note that the ideas of astrologers were altogether erroneous, and that confident faith in such fancies implies a degree of ignorance, not to say superstition, which however natural in the beginning of the Christian era, is entirely inconsistent with the belief that this portion of the first Gospel is inspired—as theologians understand inspiration.*

But perceiving the absolute impossibility of reconciling the story of the star of Bethlehem and its manifestly astrological significance with scientific facts, we are not merely led but forced to inquire whether some outside origin of the story may not be found. When we find that the Ebionites, though naturally disposed to view with special favour the Gospel of Matthew, rejected the story as foreign to the genuine narrative, we are encouraged to believe that decisive evidence on the subject must have existed in their time, which should be accessible also to us, since the Ebionites were not profoundly learned.

In reality the external origin of the tradition (once the inquiry is suggested) is as obvious as daylight.

The story of the star is told, in every detail, of the birth of each of the sun-gods—Osiris, Horus, Mithras, Serapis, and the rest.† But the original myth was not mythical at all. It belonged simply to the systematic observances which appertained to sun-worship as regulated by an astronomical and astrological priesthood. Each portion of the day determined by the sun's apparent motions was measured by astronomical observation, from the dayspring of one day to the dayspring of the next. In like manner each portion of the year determined by the sun's motion above and below the equator was measured by astronomical observations which were in truth religious observances.

The method of these observations is known, since it remained in vogue long after actual sun-worship had died out, and long after more exact methods of measuring the sun's yearly movements had come into use. Each stage of the sun's annual course was determined by the heliacal rising of a certain star, that is, the rising of the star at such a time that the star was just visible before the approach of the sun to the horizon obliterated all fainter lights from view. In variable climes this method would have no exactness at all. Even in Egypt and Chaldea it was but rough. But in point of fact all the methods employed by worshippers of the heavenly bodies were rough; for they were devised when as yet men knew little of astronomy, and they remained sacred afterwards (as always happens in such cases), despite their roughness and simplicity, partly even *because* of these.

Of all the epochs marking the sun's annual course the winter solstice, or the time when the sun's gradual descent below the equator ceases and merges into ascent, was the most important and critical in ancient times. In the earlier days of ignorance men must have feared lest the change would never be brought about, the sun passing away farther and farther south till he disappeared for ever, and with him all heat and light and life. The recognition of the fact that their god's southward course had ceased (that he was standing still, as the word solstice implies) restored hope to men's hearts, a hope changed to the certainty that he would return, bringing life back to the world, so soon as it was announced that he was moving northward from his staying place.

Later, when the religion of the sun was fairly established, the heliacal rising of a particular star was the sign for which the priests of the sun waited before they announced to the people the birth of the god of the new year. And therefore, later still, in every myth of the birth of the sun god we find this observance forming a prominent part of the story.

We have, in fact, in the story of the Star of Bethlehem, a simple repetition of what the priests of the sun actually did. They watched the sun, whose heliacal rising was to indicate the birth of the year god; as soon as they had seen that star in the east, just before the stars vanished with sunrise, they proclaimed the good news to the people. The magi, or astrological priests, watched the star in the east; the magi saw the newly-risen stars obliterated day after day by the sun of the old year (the slaughter of the innocents); the magi traced the course of the star in the east until, just at the time of the solstice (December 25, according to the old system), it came and stood over the place where the sun god of the new year was to be born, just showing above the horizon as his first rays proclaimed his approach. Then the angels or messengers of the magi announced the birth of the sun god of the year. And lastly, the magi or high priests offered up the people's gifts of myrrh, frankincense, and gold, all mystically typical of the solar worship—the sun being, in fact, in the old astrological system, represented by gold.

Such was unquestionably the manner of announcing the birth of the sun god by observation of the star of his nativity in sun-worshipping days—the details being essentially astronomical, or rather astrological. Those who can regard as accidental the agreement between all these details and the details of a story which appears only in one Gospel and was rejected by the very race who accepted that Gospel alone, must attach very little value to the evidence from multiplied coincidences.

If the explanation is rejected according to which this account is mythical and interpolated, then we have to accept the explanation given by leading theologians, accord-

* The erroneous ideas implied in this part of the narrative are not alone. The "exceeding high mountain" from whose summit "all the kingdoms of the earth and their glory" could be seen is as consistent with the science of eighteen hundred years ago as the star which appeared and disappeared and reappeared and finally travelled before the magi on their seven-mile walk from Jerusalem to Bethlehem; but it is entirely inconsistent with the geography as well as with the astronomy of scientific times. And it is hardly necessary to say that certain passages relating to the end of the world are written with manifest want of appreciation of the requirements of longitude and latitude and of a rotating world nearly 200,000,000 of square miles in area.

† Doubtless this was part of the evidence on which the Emperor Hadrian, in the year 137, based his belief that the Christians of his day were worshippers of Serapis.

ing to which the story corresponds with the astrological notions, admittedly mere superstitions, of those ancient days. I would ask whether it is more irreverent to maintain that a story which is *almost certainly mythical* and *quite certainly relates to a superstition* does not and cannot belong to the inspired word of God, or to tell the world that the inspired word of God may present ignorant and superstitious fancies as if they were truths. Men sometimes look at me sadly, especially if they are clothed in sadly cleric garb, when I reverently proclaim the former belief. They probably do not know how regretfully those of reverent mind contemplate their placid acceptance of the latter, a belief which *did they but recognise its true significance* they would perceive to be altogether irreverent.

SHAKESPEARE AND HISTORY.

THE character of Richard III., in Shakespeare's play of that name, has ever been considered one of Shakespeare's finest creations. Whether we consider the wonderful variety of aspects under which the hunch-backed tyrant is presented to us, or the force and spirit with which each is drawn, we are alike astonished and delighted. But this picture, which is so excellent an illustration of the poet's power, is no correct portrait of the third and worst of our English Richards, any more than the bodily distortion attributed to Richard III. is historically just.

So much variety of opinion has existed among historians in regard to Richard III., that it is difficult to form an opinion as to the man's real character. There is no part of history which is involved in so much obscurity as the War of the Roses. Many important incidents which, were they well authenticated, might assist us to form an opinion as to Richard's character, are differently stated by historians, or even by some entirely denied.

Possibly, I may remark in passing, the question of the character of our English kings may in itself have little interest for our readers, most of whom, I suspect, have gotten over the fashion of regarding the lives of the Kings and Queens of England as the most important parts of history. Men of sense regard our English kings as only important historically because of the immense amount of mischief their rapacity, ambition, and general villany have occasioned. Yet Shakespeare's creations are always worth studying, and we cannot but take an interest in the comparison of the picture of Richard III. drawn by Shakespeare and the real villain of history.

It was perhaps natural that Shakespeare, who wrote at a time when the intellectual progress that had begun when the Tudors were established on the English throne had reached a high development, should form an exaggeratedly unfavourable estimate of Richard III. It was natural that he should contemplate with something of horror a reign whose annals are so dark, and should ascribe to that king the largest share of the blame for all that disgraced his time—for the savage manners and the dishonourable conduct which characterised nearly all the leading men of that age. Another reason, probably, for Shakespeare's feeling of intense dislike for Richard III. was that the last king of the House of York was the personal enemy of Henry Tudor, the grandfather of that queen who, with all her faults, was the pride and glory of Shakespeare's time.* Some historians even confirm the story that Richard III. met his death at the hands of Henry VII.—a story naturally accepted by Shakespeare as dramatically effective; but there is not a shadow of evidence that they encountered on the field of battle. Had they done so, the event of Bosworth Field might have been different. For whatever his faults may have been, Richard was a stark warrior.

It is certain, be the explanation what it may, that Shakespeare has drawn Richard's character darker—which was by no means necessary—than historic truth would justify.

In the contest between the rival houses of York and Lancaster, Richard acquired early the reputation of a brave soldier and an able general. He does not appear to have been at that time in any way distinguished from his brothers, Edward and George, or the young nobility who fought in the same cause. Yet to this part of his life Shakespeare, following Holinshed, attributes two of the most brutal murders—the public stabbing of Prince Edward at Tewkesbury and the secret murder of Henry VI. in the Tower. Other chroniclers than Holinshed confirm Shakespeare in this, but it is exceedingly unlikely that Richard took any personal part in either murder.

In like manner, the murder of Clarence, which Shakespeare attributes to Richard, and represents Edward as regretting, was almost certainly ordered by Edward alone. Edward was as unscrupulous as Richard subsequently proved to be, and Edward's suspicions of George show that in all probability the three brothers were fairly matched in this respect. The Plantagenets, as a family, never allowed kinship to interfere with their ambitions, any more than did their Norman predecessors, or the Tudors, who succeeded the rival Plantagenet houses of York and Lancaster.

On the death of Edward, Richard does not at first seem to have entertained any idea of seizing the crown. He was justified in claiming the protectorate, not only by his near relationship to Edward, but by the general prejudice against the Woodvilles (the family of Edward's widow). But from the moment Richard obtained the regency he was placed in a position in which he found it impossible to maintain himself without constant watchfulness. The Queen's family began to form plots and intrigues against him. He knew that the authority he possessed while Prince Edward was a minor would not secure him against future dangers. The young Prince, as he grew up, would be most likely to side with his mother. Besides, he could scarcely but recall the fate of another Gloster who had held a similar position, and had been murdered when the Prince for whom he had held the reins of power had mounted the throne. It was with such dangers before him that Richard was led to assume the sovereignty, an act doubtless of treachery and villainy,

* Mr. Donnelly's assertion that the writer of the historical plays hated and even despised Elizabeth is fairly disposed of by the closing scene of "Henry VIII.," when the historical plays merge, as it were, into contemporary history:—

> "The words I utter
> Let none thinke flattery; for they'l finde 'em truth.
> This Royall infant, Heaven shall move about her;
> Though in her cradle, yet now promises
> Upon this land a thousand thonsand Blessings,
> Which time shall bring to ripenesse; she shall be
> (But few now living can behold that goodnesse)
> A Patterne to all princes living with her,
> And all that shall succeed. Saba was never
> More covetous of wisdome and fair Vertue,
> Than this pure Soule shall be! All princely graces
> That mould up such a mighty piece as this is,
> With all the Vertues that attend the good,
> Shall still be doubled on her."

With much more to the same effect. All this in the folio edition, where Mr. Donnelly reads his Baconian abuse and ridicule of Queen Elizabeth. Note, moreover, that this was probably written after Elizabeth's death ("Richard III." was written many years before that event).

even though it was thus intended as a means of safety against the treachery and villainy of others. How far the character of his opponents would have justified the seizure of power from them need not be considered. The wrong was done against one who was at least innocent of any actual offence against Richard. Yet we must recognise some distinction between an act of rapacity almost essential to Richard's safety, and an act of villainy deliberately plotted against the innocent Prince, his nephew.

Up to this point in his history Richard had been far from encountering that universal hatred which is pictured in Shakespeare's play. On the contrary, he seems to have been rather popular than otherwise; and his accession to the regency was hailed with delight by the English people. But we enter now on a darker scene, of which this act was the prelude. It rendered Richard at once unpopular. Our English race has always, even in the days of its semi-savagery (the good old times, as some fondly call them), been quickly excited to indignation at the sight of the weak and innocent oppressed by the crafty and rapacious. The executions—murders though they perhaps were—of Rivers, Grey, and Hastings had been so much in accordance with the practice of those pleasant times, that they had attracted little notice and roused still less excitement. But in depriving the boy-Prince of his inheritance Richard was offending the whole nation, while exposing England to a repetition of those scenes of horror which had but lately ceased, and from the effects of which the country was still suffering severely. Accordingly, Richard found this measure received with so much indignation, and his new power so insecure, that the murder of the Princes seemed to him the only way to protect himself from those who were eager to restore to them their rights.

The murder of the Princes was Richard's destruction. The wrath of the English people at his usurpation turned at once into execration; and thenceforward there was no villainy of which they did not believe him capable, scarce any known to have happened during the evil days of the War of the Roses of which they were not prepared to regard him as the actual perpetrator. Men could scarcely believe that so unnatural a murderer possessed the form or attributes of humanity. It is difficult, even now, for any one of the English race to do such justice to Richard as should be meted even to so great a villain. We must not forget, however, that—though hanging would have been too good for him—there is a distinction between murder suggested by unscrupulous ambition combined with the dread of imminent danger, and that inherent ferocity and brutality, that love of cruelty for cruelty's sake, which characterises the Richard of Shakespeare's creation.

It is interesting to notice how Richard's crimes and their punishment were connected. The usurpation by which Richard had sought to make himself secure brought greater dangers with it. The crime by which he thought to protect himself against these led to his overthrow and death. We cannot wonder that even in the semi-savage England of the fifteenth century this should have happened. The light of chivalry, such as it was, had been dimmed amid the disorder and depression of the civil war; yet the nation was not slow to raise its voice in ominous tones against the king who had been guilty of a crime so cruel and so cowardly. Richard himself seems to have begun to recognise the finger of Providence in the misfortunes which now began to fall upon him. His demeanour and gestures during the latter part of his life indicated the terrors suggested by a guilty conscience. He continued to oppose with vigour and capacity the plots and intrigues which now thickened around him, but it was with evident anxiety as to the result. He could no longer trust his nearest friends. He could perceive fear and hatred ill-concealed in the countenances of all around him. When the storm which had so long been gathering on the horizon at length burst over him, Richard found the means he had prepared to stay its progress turned against himself.

Richard's conduct, however, in this last scene of his life was marked by singular courage and energy. He fought resolutely to the last, and he finally met defeat and death on Bosworth Field with all the valour for which the Plantagenets had long been famous.

In the Richard of history, then, we have a man distinctly different from the Richard of Shakespeare's play. Possessing energy and talents, and a high position in the nation, Richard III. found himself so placed that these advantages involved serious dangers. There seemed to him to be no middle course: he must either do or suffer wrong. That he chose the former in such an age, though it must be condemned, is not greatly to be wondered at. His character has been well summed up in the statement that "he differed little from the ordinary nobleman of his time, except that circumstances gave him the power to perform signal acts of treachery and to profit by them."

As regards Richard's capacity there can be no question. Every act of his recorded by history speaks of the man of energy and decision, who amidst plots and intrigues sees at once the best path for safety, and follows it without scruple or compunction. He would probably have failed had he attempted to oppose secret plots with craft and policy. He met them and dispersed them openly and vigorously. In the family of Edward's queen he had to contend with those who, having been raised from an humble condition, entertained a natural aversion to a prince whose family claims were older and stronger. They spared no efforts to bring about his overthrow.

We cannot rightly judge, however, of the character of the Richard of history, nor rightly appreciate the Richard of Shakespeare's powerful play, without considering the tendencies of that dark and gloomy age. In judging any man's conduct it is always important to consider the times in which he lived, but it is specially so in the present instance. There has seldom been an age whose character has been so marked as was that of the age preceding the Reformation. Generally in each succeeding era of a nation's history the elements of good and evil, of order and disorder, exist side by side—in different degrees, but still actively present, and in some degree counteracting each other. But at the close of the War of the Roses the elements of order seemed to have almost wholly disappeared. The very groundwork of society seems shaken. The kingly power, the Church, and the nobility, had all at the same time lost their influence on the people, while the people were, as yet, altogether unable to control their own destinies.

England had seen the throne occupied by the usurper Henry IV., the rightful king murdered, the lawful heir in prison. After the brilliant but short reign of Henry V. they had seen his son a mere puppet in the hands of the nobility—now in the nominal possession of power, anon flying for his life. It was natural that they should lose that devoted attachment which the kingly dignity had once inspired—an attachment which, worthless though it would be now, was once an important element of the nation's strength.

It was the same with the Church. The nation had seen its abuses laid bare by Wycliffe and his followers, and had also felt by bitter experience the change which had taken place from the comparative purity of former times. They noted the selfish and often evil lives of many who professed to be their teachers; they suffered from the rapacity and avarice of the priesthood of the time. We cannot wonder,

then, that the Church had lost the hold it had once had on the confidence, if not on the affections of the people.

The nobility had in large degree forsaken the chivalry of their forefathers, which, though coarse, was wholesome. They were no longer distinguished from the commonalty by valour or capacity, but only by splendour and luxury.

While the old order had thus passed away, the new order which was to replace it had not yet appeared. A sense of insecurity, accompanied by a dissolution of all restraints of honour, can be recognised in all classes in that dark era of English history. As Hume has well said, "All that we can distinguish with certainty through the deep cloud which covers that period is a scene of horror and bloodshed, savage manners, arbitrary executions, and treacherous and dishonourable conduct in all parties." If any man in that age had reason to feel its savagery, or was likely to be influenced by it, it was Richard. In the earlier part of the civil war his family were treated as traitors and rebels, his father was slain, one brother forswore himself and fought against his own relations, another murdered his traitorous brother, and he himself had been compelled to endure and inflict wrongs of the most cruel nature. His usurpation and the crimes which followed it were a very natural sequel to a life-experience so brutalising.

Of Richard's domestic life we know little. History gives no sort of support to the stories of domestic villany introduced as parts of the picture of the Shakespearian Richard. It is unlikely that the real Richard was a dutiful son or an affectionate husband, but history does record that he was a loving father. Nay, some historians attribute his worst crimes in part to his anxiety to secure the throne for his son Prince Edward.

ARCTIC ORIGIN OF ARYAN RACES.

THERE are few developments of the general doctrine of evolution more interesting than those which relate to language. The discussion of the origin of languages and dialects, and their development after they have come into existence, is sufficiently interesting; but more interesting still is the study of languages in their relation to the past history of races. It is as bearing on the evolution and development of races, much more than as bearing on the evolution of language, that philological researches chiefly interest the student of science.

There is one subject of special interest in the past history of races on which the study of language promises to throw light. Whence did each race first come? Whence, in particular, did that great division of the human race, the Aryan or Indo-European, to which we ourselves belong, take its origin? Over what regions, again, has this particular stream of human life flowed since first it had separate existence?

Of old, when the more thoughtful strove to deal with such questions as the diversity of language, they gave comparatively simple answers to such questions as these. It was enough to suppose that all men originally spoke one language, and that that language was miraculously confounded, insomuch that different sets of men and women (quite possibly different pairs) had to form different races and nations. There was no difficulty in all this to primitive thinkers. They could see no special reason why a single pair should not start a thriving race; indeed, they imagined the process repeated whenever some new race was to be originated, especially when it seemed to them that by such a theory either the importance of their own special family might be enhanced, or the specially undesirable character of their own enemies might be indicated.

The question of the origin of Aryan races was one of those with which primitive thinkers dealt in this simple fashion. It was enough for them to conceive the Japhetic, Semitic, and Hamite races to have sprung from three men, sons, indeed, of one father and one mother, but by special interposition of deity provided with different, nay, widely contrasted racial characteristics. It is to be presumed that, following on this special ordinance, there was understood to have been some arrangement by which the three great divisions of the human race, thus originated, were kept distinct one from the other—besides, of course, that miraculous ordering of things by which the degeneration of the descendants of a single pair was supposed (if any attention at all was given to this difficulty) to have been in some way prevented.

It is hardly necessary to say that the Japhetian theory of the origin of Aryan races has long since taken its place with students of science beside the Babel theory of the origin of languages. The Caucasian theory of Blumenbach, though it held its ground long enough to give wide circulation to the term Caucasian as a fit name for the Aryan races, has also long been abandoned. But no satisfactory solution had yet been obtained for the problem of the origin of the Aryans. Pott, Lassen, and Max Müller maintained that the highlands of Central Asia had in all probability been the cradle of these races; but there was very little evidence to show that this theory was correct. The chief argument used by those who supported it was based on the supposition that Sanscrit is nearest of all the Indo-European languages to the primitive Aryan—a belief, however, for which the evidence was very slight. We can clearly trace back the course of the Aryans into Lower India from the valley of the Ganges, and into this region from the Punjaub, into which region again they doubtless entered from the Hindoo Koosh. But we can trace them no farther back. It is true that the farther west of India we trace the language the less original we find it, insomuch that we may fairly infer that, while the Aryan Indians migrated to the south-east, the Aryans of Persia and Asia Minor migrated westwards. For all these sections of the Indo-European race we may find a cradle in the highlands of Central Asia west of Murtag and Belurtag. But we cannot conclude safely from this that those highlands were the cradle from which the whole Indo-European division of the human family came. The Greek, the Roman, and the Romanic languages may be referred to the same Central Asian source from which the Persian or Iranian and the Sanscrit were derived, and yet it would remain unproved that the Hungarian and Lithuanian languages and dialects were derived thence, and with doubt on this head would come in doubts as to all forms of Teutonic and Celtic languages.

Now the researches of Cuno, Geiger, Schrader, and Penka tend to show with constantly increasing force of evidence, that the languages of Middle and Western Europe were derived from regions lying north and east of these regions—in other words, from the regions around the Baltic. The Rev. Canon Taylor, in a paper of singular interest recently read before the British Association, points out that the evidence indicates the Baltic provinces of Russia, or what we used in old times to call Finland, as the central region from which the Aryan races spread—one great division travelling southwards and eastwards over the central highlands of Asia, to occupy India, Persia, and Asia Minor; another travelling southwards and westwards over Prussia, Poland, Hungary, Germany, Denmark, Gaul, and the British Isles. Each of these great divisions threw off branches in various directions, insomuch that we find the

Aryans who had first spread eastwards extending themselves westwards beyond Asia Minor to Greece and Italy, while of the Aryans who had first spread westwards, some extended themselves northwards into the Danish peninsula, and then westwards and southwards over the British Isles, France, Spain, and even Africa (where the Kabyles are distinctively Aryan) and others passed from parts of Southern Germany eastwards again. On such points there must ever remain much doubt, but the evidence grows clearer and stronger, year by year, that the real centre of dispersion was in North-eastern Europe, and not in Central Asia.

MATERIAL OF THE UNIVERSE.

(Concluded from page 58.)

TOUCHED in my last on the relative masses of the various members of the solar system, and in so doing considered in a sense their relative might, for on account of that mysterious power which matter possesses of attracting matter we measure the strength of each orb in the universe by its quantity of matter, to which its attractive action at any given distance is strictly proportional.

But there are other circumstances by which the importance of the several planets, measured by reference to the sway which each is capable of exerting on surrounding matter, is influenced, if not directly determined.

For example, consider the power which the sun has of communicating velocity to matter drawn to his surface from a distance. In this there is not only evidence of attractive might, but also of potentiality in regard to other attributes not less important to the sun regarded as the chief orb of the solar system. For the sun's light and heat, as well as other qualities which he possesses as a radiant orb, depend on this effect of his attractive energy. We do not, indeed, at present attach much weight to a theory once in vogue, according to which the sun's light and heat were regarded as due to the actual impact of meteoric bodies drawn toward him in countless millions from outer space. But the theory now generally accepted, according to which the sun's heat is the thermal equivalent of the mechanical process of contraction, going on constantly in consequence of the sun's powerful attractive action on the materials of his own globe, does in reality quite as definitely attribute his light and heat to his attractive energy as did the old meteoric theory; and we may take the velocity he is capable of generating in bodies drawn to him from great distances as affording a measure of his power—one might almost say his vitality—in this respect, quite as confidently as though the direct impact of such indrawn matter stirred his surface to intense heat, and so caused it to glow with intense lustre.

Now assuming as I do throughout my book (still in the stage of growth) that the sun's distance is 92,780,000 miles, which I consider probably far nearer the truth than Newcomb's ninety-two and one-third millions, I find that his mass amounts to 330,500 times the earth's, and that the velocity with which matter drawn to his surface from an indefinitely great distance would impinge vertically upon that surface is no less than 382·57 miles per second. It is hardly necessary to say that none of his dependent orbs compares with him in this respect. If a body were let fall upon Jupiter from an indefinitely great distance, being drawn to Jupiter's surface by that planet's sole attraction, the velocity of impact would be but 37·37 miles per second. In Saturn's case the velocity would be 22·58 miles per second; in Neptune's case 13·72 miles; in the case of Uranus 13·25 miles; in the earth's 6·913 miles (this represents the velocity of seven miles per second with which Jules Verne's Columbiad had to shoot forth those venturesome travellers to the moon); in Venus's case the velocity of impact, always supposing each planet left alone to generate the greatest possible velocity, would be only 6·218 miles per second; in the case of Mars it would be 3·179 miles; in that of Mercury 2·901; while lastly, our small companion planet, the moon, if left to do its best alone on matter approaching it from a very great distance, could not generate a greater velocity than 1·482 mile in each second of time—though this, by the way, is a considerable velocity, being about four times the velocity with which a cannon-ball leaves the mouth of the best cannon men have yet been able to construct.

But no planet is able to exercise its control on an approaching orb in this undisturbed fashion. There is only indeed a comparatively limited region within which the rule of a planet is superior to that of all other bodies, even including the sun. Each planet has in this sense a special domain, the limits of which are determined by the consideration that whereas a body outside those limits is drawn more strongly toward the sun than toward the planet, within them the reverse holds, and though it may be but for a time that the planet exerts superior influence, the influence of the planet on a body so situate is greater than that of the sun or than the combined influence of the sun and all other bodies whatsoever.

The sun, however, is the only orb whose power in diminishing the control of the several planets over surrounding space need be considered, all other influences being relatively insignificant. He affects the rule of planets in two distinct ways:—First, by his direct power in drawing matter toward him more strongly than any planet can, unless the body is comparatively close to its surface; and secondly, by communicating such velocities to bodies moving within the solar system that even when they enter the domain of a planet they remain within it but a short time. Since his power in both respects depends on his distance, or rather on the planet's distance from him, we find the outer planets set in a relatively higher position as independent rulers than the mere superiority of their mass would imply; nay, the outermost of the outer family is set absolutely higher in regard both to extent of domain and influence within such domain than even the two chief planets Jupiter and Saturn themselves.

I have calculated the extent of the domains of the several planets, and the velocities with which matter entering those domains would pass through them independently of the action to which they are exposed during their passage. The results are, I think, interesting, presenting, as they do, the relative sway of the different members of the solar system in a somewhat new light.

All the four terrestrial planets have domains very limited in extent compared with those of the four outer planets. The spherical domain of Mercury has a diameter of only 32,000 miles; and as bodies which chance to pass through it have velocities ranging up to no less than 42 miles per second, Mercury's chance of much influencing bodies passing near him is very small. Our own moon, though she has less than a fifth the mass of Mercury, has much more power in this respect, her domain being about 36,000 miles in diameter, while the greatest velocities of bodies passing near her are but 26 miles in a second. Venus has a domain 106,000 miles in diameter, and at her greater distance from the sun the maximum velocity of passing bodies is reduced from the 42 miles per second

noted in Mercury's case to only 30 miles. Our earth has a domain about 322,800 miles in diameter, and the maximum sun-imparted velocity of bodies entering that domain is 26 miles per second. As the span of the moon's orbit is nearly 478,000 miles, the moon is not within the earth's domain, nay, lies 77,500 miles beyond the range within which the earth's rule is supreme, so that the moon is to be regarded as a companion planet rather than as a mere satellite. Mars is the only member of the sun's special family of planets—for so I think we must consider the terrestrial planets to be—which has dependent bodies under its own special influence. For the domain of Mars is nearly 165,000 miles in diameter, while his satellites travel at distances of only 5,820 miles and 14,600 miles, respectively, from his centre. At the distance of Mars the greatest velocities of passing bodies, so far at least as solar influence is concerned, amount to 21 miles per second, and Mars can do little to perturb bodies moving so quickly, even though their course should carry them through the very midst of his domain.

So soon, however, as we pass to the wide region within which lie the paths of the giant planets, we find planetary domains far wider in extent and wherein planetary influences are exerted under conditions much more favourable. The domain of Jupiter has a diameter of nearly 30,000,000 miles, within which the whole system of the Jovian satellites, the span of which is but 2,800,000 miles, is swayed by the planet's supreme influence, slightly modified by the sun's perturbing action, indeed, but only in the same sense in which the motion of the earth around the sun is modified by the perturbing action of Jupiter. The domain of Saturn is even larger, but so slightly that one may speak of the domains of Jupiter and Saturn as practically equal. (Their actual diameters are, respectively, 29,824,000 miles and 29,912,000 miles.) And though the Saturnian system of satellites has nearly twice the span of the Jovian system, the diameter of the orbit of his eighth satellite being no less than 4,500,000 miles, yet this system is as completely under Saturn's control as the motions of the terrestrial planets are under the control of the central sun. Matter which has entered within these two nearly equal domains travels with sun-imparted velocities ranging up to eleven and one-half miles per second in the case of Jupiter and to eight and one-half miles per second in the case of Saturn. Over matter so moving both Jupiter and Saturn may exert very considerable influence, modifying not only the direction of motion, but also — which is a point of much greater moment — its velocity, and so modifying the span and period of orbital motion which such matter may have had around the sun. It is to be noticed that not only is the domain wide in each case within which either Jupiter or Saturn exerts superior influence, but the comparatively slow motion of sun-influenced matter through that domain causes the matter which has entered it from without to be much longer subjected to disturbing influence than it would be if it rushed along there with the velocities of 21, 26, 31, or 42 miles per second with which matter crosses the domains of Mars, the Earth, Venus, and Mercury. In this respect Uranus, with a smaller domain than either Saturn or Jupiter, and weaker influence within that domain, has an advantage over both those chief giants of the solar system. For the greatest velocity (sun-imparted) with which matter can pass through the domain of Uranus falls short of 6 miles per second. The span of the domain of Uranus is not far short of 24,000,000 miles, and the system of Uranian satellites, the span of which is about 1,000,000 miles, lies well within the limits of the Uranian domain. But Neptune is, of all the members of the solar system, the one whose domain is widest, and whose influence within his domain is most strikingly paramount. This domain has a diameter of more than 10,000,000 miles, and in volume it is nearly equal to all the other planetary domains put together. Matter passes through this domain when entering it by chance from without under solar influence only, with velocities which range no higher than $4\frac{1}{4}$ miles per second; and as Neptune is so powerful that matter drawn to his surface under his own influence alone would have a velocity of impact amounting to $13\frac{3}{4}$ miles per second, it is evident that Neptune must be capable of perturbing the movements of such matter in very large degree.

Such are the relations of matter as we find it distributed within our solar system. A total quantity of matter surpassing even the tremendous mass of the earth no less than 331,000 times appears in this system aggregated into various discrete masses, nearly all, however, being at the centre, whence it may not only influence but warm and illuminate all the rest. We see the various masses, according to their amount and position, exercising sway over larger or smaller regions of space, and over more or less important subordinate systems. We note, further, the antecedent probability—and the evidence obtained by observation assures us of the actual fact—that the larger these several masses are, the more they retain of the heat due to the primary process of their aggregation, the more nearly do they resemble the chief mass in their power to warm—possibly in their power to illuminate also—the bodies circling around them.

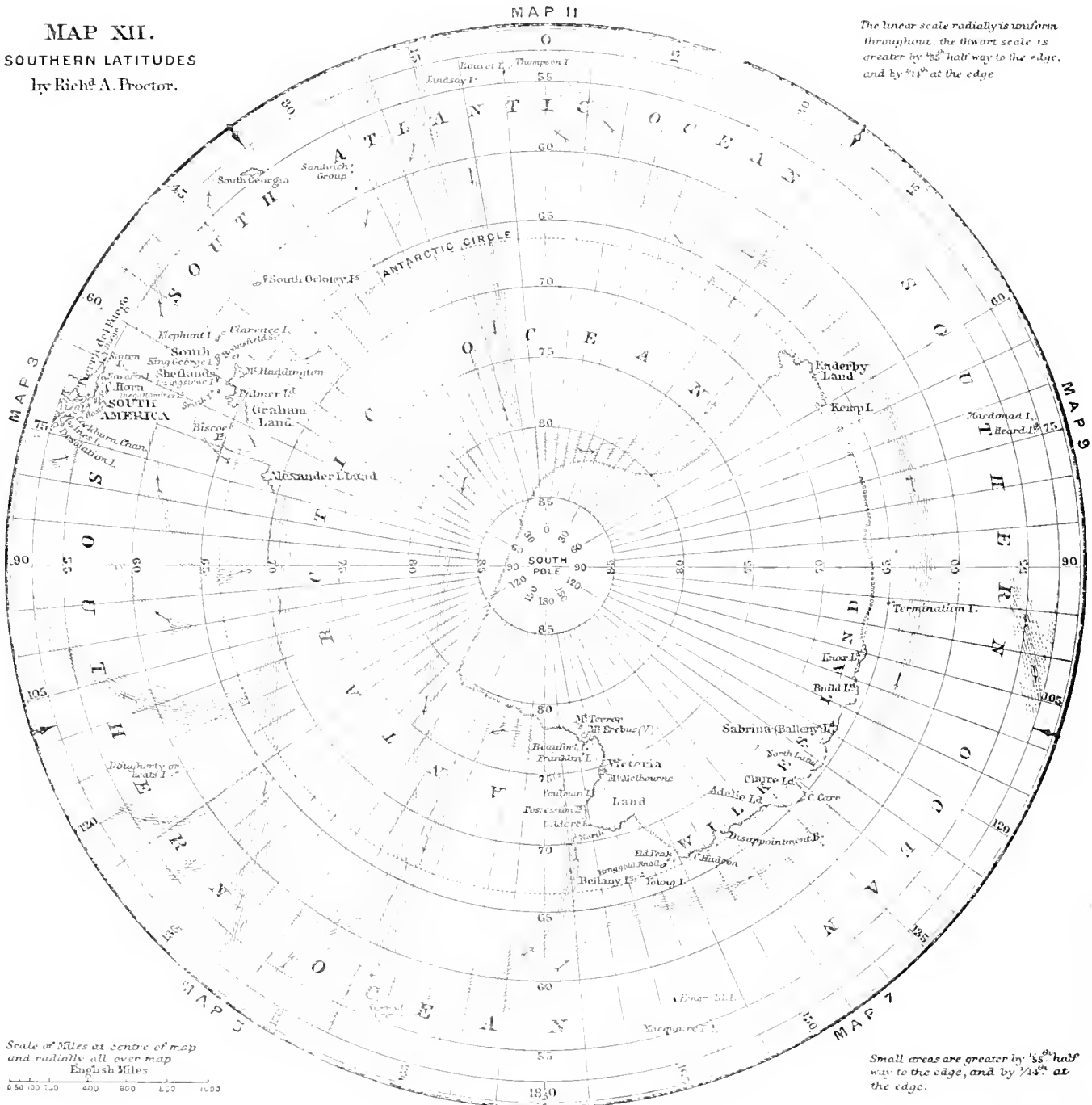
If these details of our solar system were not, though I think they are, most interesting in themselves, they would be made supremely interesting by the consideration that each one of the stars tells us of an aggregation of matter resembling our solar system doubtless in origin, though the circumstances of their formation may have led to different details alike of distribution and condition. Here in our solar system certain processes acting according to the known law of universal gravitation, and also according to those physical laws on which the generation of the so-called physical forces depends have led to the gathering together of an enormous central mass with the generation and steady emission of immense quantities of light and heat. Yonder in space we see in each star evidence of the steady emission of immense quantities of light and heat, assuring us of the past aggregation of immense quantities of matter. Our solar system is the one case we can actually study of the aggregation of matter under laws not yet clearly recognised, and still farther from being fully interpreted. It may perhaps be in one sense as hopeless to endeavour to guess how other such aggregations have been formed as it is to endeavour to ascertain from our earth's life history the life histories of her fellow-worlds, or from the condition of our moon the state of all such orbs as have, like her, passed onward to the final stage of orb life, the condition of death. But even as from the laws of the life of any one animal we can form a general idea of the laws of the lives of other animals, and as the study of one plant affords data for the determination of the general laws of plant life, so we may fairly infer the general nature of the final stage of orb life from the condition of our moon, the general laws of world life from the life history of our earth (so far as we have been able to read it), and lastly the general nature of other sun-circling systems from the study of the distribution of matter within our solar system, and the state in which the matter so distributed exists, whether in the supreme central mass, in the larger or smaller among the subordinate masses, or in the relatively minute subdivisions of the original material of the system which we recognise in asteroids and satellites, in meteorites, aerolites, and finally in the particles of mere cosmical dust whose presence is attested by the phenomena of falling stars.

THE ONE-SCALE ATLAS.

MAP XII.

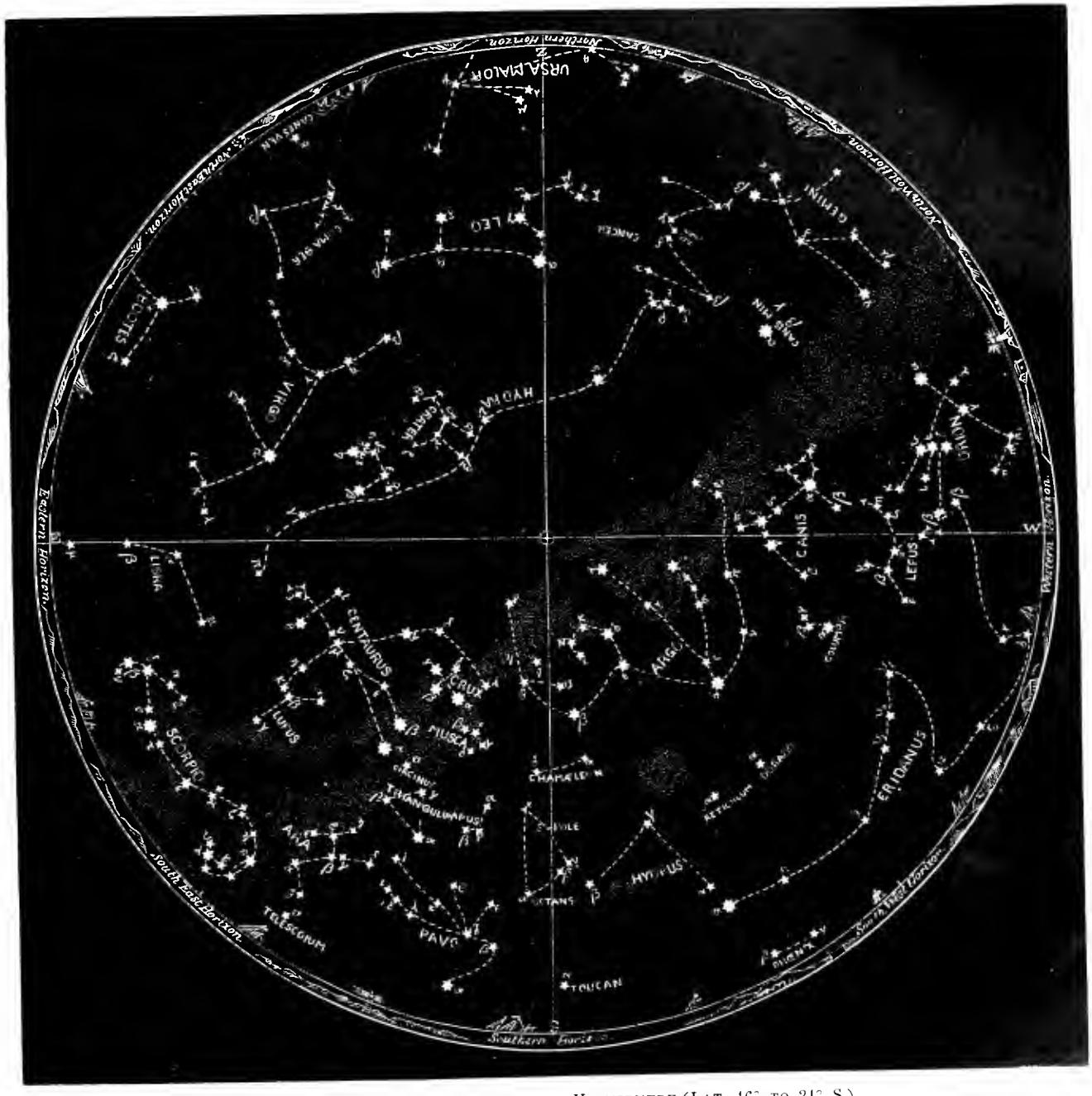
SOUTHERN LATITUDES

by Richd A. Proctor.



THE SOUTHERN SKIES.

MAP XVI.—FOR JANUARY, FEBRUARY, AND MARCH.



THE NIGHT SKIES IN THE SOUTHERN HEMISPHERE (LAT. 46° TO 24° S.)

AND THE

SOUTHERN SKIES IN ENGLAND (UPPER HALF OF MAP ONLY) AT THE FOLLOWING TIMES:

At 1 o'clock, morning,	Feb. 7.	At 11 o'clock, night,	Mar. 8.	At 9 o'clock, night,	April 7
„ 12.30 „ „	Feb. 14.	„ 10.30 „ „	Mar 15.	„ 8.30 „ „	April 15.
„ Midnight,	Feb. 22.	„ 10 „ „	Mar. 23.	„ 8 „ „	April 23.
„ 11.30 o'clock, night,	Mar. 1.	„ 9.30 „ „	Mar. 30.	„ 7.30 „ „	April 30.

STAR MAGNITUDES.

First . . . ✱ Second . . . ★ Third . . . . ★ Fourth . . . . + Fifth . . . . ▲

ROYAL VICTORIA HALL.

(To the Editor of Knowledge.)

MR. F. W. RUDLER gave an admirable lecture on Tuesday, the 17th inst., on "Caves and Cave Men." The lecturer began by saying that the London clay, gravel, and sand are too soft to admit of the formation of caverns, which occur chiefly in the chalk and limestone. He showed, by photographs of the rocks near Flamborough Head and on the Dorsetshire coast, how the destructive action of the waves, keeping up a perpetual cannonade of small stones against the cliffs, washes away the softer portions of the rocks so as to form caverns. Water acts also by dissolving the chalk. The rain-water absorbs carbonic acid from the air, which enables it, as it trickles through the fissures, to dissolve a little of the chalk or limestone, thus gradually enlarging the fissures till it forms large caverns. Mr. Rudler, with the help of some beautiful photographs, explained how the water, charged with limestone, drips from the roof and forms stalactites and stalagmites—the former resembling icicles hanging from the roof, the latter formed underneath them by the drip, and rising in conical masses from the floor, or sometimes consolidated into a floor of remarkable hardness. The cave of Gayleureuth, in Germany, is of this kind. Under the stalagmite floor is a red-brown loamy earth, which has been long known to contain bones. Goldfuss and Cuvier discovered that these were the bones of extinct animals. In 1822 the skeleton of a large animal was found in a lead-mine in Derbyshire, and this proved to be the skeleton of a rhinoceros, an animal now found only in Africa. In the cave of Kirkdale, in Yorkshire, were found an immense number of bones, which Dr. Buckland ascertained to be chiefly those of the hyena, now met with only in Africa and Asia. Other bones which were found with them appeared to have been gnawed; and, comparing these with bones gnawed by hyenas in Wombwell's menagerie, Buckland found that they had been gnawed precisely in the same manner. Clearly, then, this had once been a den of hyenas. Other animals of which bones have been found in this or other caves are the cave-bear, the cave-lion, the Irish elk, and the mammoth. What this latter animal was like we are not left to infer merely from its skeleton, for a carcass of one was actually found in Siberia so perfectly preserved by the ice in which it was imbedded that dogs ate some of the flesh. It was a kind of elephant, with long curved tusks and long hair, fitting it to live in comparatively cold climates.

Was man living at the time when these animals existed here? Other caves enable us to answer this question in the affirmative. In 1852, Professor Boyd Dawkins found in Wookey's Hole, in Somersetshire, together with bones of the hyena and cave-bear, a number of stone weapons, evidently chipped and sharpened by the hand of man. In Kent's Cavern, at Torquay, are two distinct strata containing bones, separated by a floor of stalagmite 2 feet thick. The upper layer contains stone implements much less rude in construction, evidently the product of a higher stage of culture, together with needles and fish-hooks made of bone, and also the skull of a very formidable kind of tiger. These early men were not without some knowledge of art; for we find scratched on some of their bone implements very tolerable representations of the reindeer, the mammoth, and the Irish elk, and even of a hunt, with the figure of a man. The cave-men appear to have lived by hunting and fishing, with weapons of stone, bone, and wood, and to have clothed themselves with skins, which they sewed together with bone needles. When men took to agriculture and learnt to build huts, they, as a rule, no longer lived in caves. But caves have been used in later times as rallying-points, or for purposes of concealment or defence, or as places of sepulture.

The lecture was illustrated by excellent lantern views. It was listened to with profound attention, and greatly applauded at its close. The chairman, Mr. Marshall, announced that the lecture on the 24th inst. would be by Professor Bonney, F.R.S., on "The Oldest Monuments in Britain and Brittany." We understand that he will be followed, on the 31st, by Professor Ramsay, on "Speech made Visible; or Picture-writing as it was and as it is"; and that on February 7 Dr. Percy Frankland will lecture on "Germs in the Air"; and on February 14, Mr. E. Wethered on "Volcanoes and Earthquakes."

M. C. Martineau.

1 Clifton Place, Sussex Square, W.

NOTES ON AMERICANISMS.

Grist. A large quantity. So far as I know, this term is not used in this sense in England, even as a provincial expression.

Grit. A term for strength of character. It probably had its origin in districts where grindstones or millstones were much used; for the value of these depends on their strength or hardness of texture, and only sandstone possessing good qualities for grinding can properly be called *grit*, or be said to have *grit*. The term is probably in use in parts of England in the same sense, but I have not heard it so used, nor seen it in local papers or other provincial literature.

Gritty, naturally, as the adjective derived from "grit," signifies spirited or courageous.

Grocery, for a grocer's shop, is as much English as American; but "grocery" used for a bar-room is decidedly an Americanism. "Fetch on your groceries" addressed to a bar-keeper or saloon-tender signifies bring forward whisky and other spirits.

Groggery is, however, also used instead of "grocery," as equivalent to our English "grog-shop."

Ground Hog Day in certain States represents Candlemas Day (February 2), because the ground hog (*Arctomys monax*) is looked for on that day. If seen to come out of his hole and return to it on February 2 cold weather will last long; but if he stays out there will be an early spring.

Ground-nut. The pea-nut, so called because it buries its pods underground, after flowering, till the pods are ripened. The pea-nut is a peculiarly American institution, like chronic catarrh. It is characterised, so far as a stranger in the land can judge, by an entire absence of all desirable qualities, and several hateful ones, as a most unpleasant and diffusive odour, and a power of dispersing its shells over a singularly wide area during the process of consumption by free and independent youth.

Ground-peas. The pea-nut again.

Gruv for grieved is, let us trust, a true Americanism.

Guardeen. A quaint New England way of pronouncing *guardian*.

Guess, To. The use of this word to imply belief rather than conjecture is now an Americanism, though formerly pure English; its use where there is not only belief, but knowledge, is even more characteristically American, or rather Yankee, for the usage is provincial even in the States.

If we consider the origin of the word, which really signifies to *get*, we can understand that the meanings given to it should be varied among English-speaking races. Thus, when

"guess" is used to signify conjecture without any knowledge at all, it rightly represents the idea of *getting*, just as the word "find" is rightly used in such a sentence as "I cannot find the way." "Can you guess this riddle?" means "Can you *get* its answer?" even though every attempt depends on pure conjecture. But equally "I can guess your meaning" is correctly expressed, though it implies not mere conjecture without knowledge, but right opinion based on just reasoning. The first of the two American usages mentioned above is equally within the limits of the word's origin. Such expressions as "I guess it will rain," "I guess you're tired," and so forth, mean that such is the opinion I *get* on thinking about the matter, whatever it may be. And lastly, the use of the word "guess" to imply certainty very obviously corresponds with the idea of *getting* at some thought—getting at it *certainly* instead of doubtfully.

It appears to me that the American way of saying "I guess," "I calculate," "I reckon," and so forth, instead of expressing definite assent, is to be regarded as characteristic in much the same fashion that an Irishman's way of saying "I will," "I did," "I do," &c., instead of saying simply "yes," is characteristic. For I notice that in many other cases Americans use a method of expressing assent akin to saying "I guess so." Thus, you ask an American at table if he will partake of such and such a dish, and his answer, instead of being given in the usual English form, will probably be, "I believe I will." Again, if you ask whether in some matter the case is such and such, the answer may take any one of a score of different forms rather than simple "Yes"—from "That's so," or "That's the shape of it," down to "You may bet your bottom dollar," or "You may bet your pile," or "You may bet your boots on *that*." The true American seems to have a strange objection to saying simply "Yes." Even "Yes, sir," does not satisfy him, except where the expression of assent has to be very often repeated. Occasionally he may say (euphemistically, as Bartlett puts it), "Yes, sirreëbob," a strange affirmative, which, so far as I know, has not yet appeared in literature, common though it is in conversation; but usually he prefers to say, "I guess that's so," or "I reckon that's about the way of it," and the like, though there is no real "guessing" or "reckoning" in the matter. Why this should be so, while his English cousin stands by the old ways and makes his yea yea and his nay nay, it would be difficult to determine.

In old English, by the way, "I gesse" seems to have been equivalent to the "ywis" of Chaucer, and to the "wus," "wusse," and "I wusse" of the less cultured characters in the plays of the early English dramatists. I have sometimes thought that the presence of the silent "u" in the later spelling of the word indicates a real connection between "guessing," "wissing," "witting," and so forth, even as the forms "guard," "guardian," &c., are connected with "ward," "warden," &c. But I suppose the connection between "guess" and "get" has been made out to the satisfaction of philologists, or it would hardly be so confidently insisted upon as it is.

Gulch. A deep ravine caused by the action of running water. The word is akin to the Swedish *gölka*, to swallow.

Gulf States. Texas, Louisiana, Mississippi, Alabama, and Texas, the States bordering on the Gulf of Mexico.

Gum. The use of the word "gum" for gum-tree is probably purely American. And certainly the use of the same word for india-rubber, and thence for anything made of india-rubber, is strictly American slang. It will be remembered that not long since the *Saturday Review* (some of whose young buccaneers would write an essay on Gujerati, knowing nothing beyond plain English, or on the scenery of the river Lena, having seen but the Thames and Severn) gravely told its readers, in an article intended to crush these American notes of mine, that recently in Philadelphia the word "gums" had come to be applied to india-rubber over-shoes—or something "to that defect." As a matter of fact india-rubber shoes have been called "gums" for generations. The expression has been familiar, not only to my own ears, but in my own mouth, for more than fourteen years—ever since, in fact, in December 1873, my esteemed friend, the late Professor E. L. Youmans, enlightened me as to the use of the word by asking at the Century Club (about 2 A.M. on a frosty morning) if any one had seen his "gums." But for a *Saturday Reviewer*, who probably had never travelled beyond Margate or Brighton, it was something to know even *so* much—or so *little*—about Americanisms.

COLLISIONS AT SEA.

By Sidney G. D. Andrews.

MY attention has been drawn to an article written under the above heading in last month's issue of this paper, discussing the "Action of the rudder upon steam and sailing vessels." The writer has undoubtedly put forward an argument that at least would serve as a judicious warning to all seamen against the reckless use of the helm (especially the port helm). Yet his argument becomes somewhat weak when he infers that the present regulations ought to be modified.

Before I say anything of those regulations, I will first of all take the examples he has put forward to prove his case, and endeavour to show that neither of them in any way shows the regulations for preventing collisions at sea to be at fault.

His first example was when the Cunarder *Merlin*, leaving Halifax on a voyage to Bermuda, came into collision with "a large square-rigged vessel." He gives me nothing reliable to go upon as an argument, but simply quotes the commander's reply to his remark: "A pretty close shave that, Captain S——." "Yes, but if I had followed the sailing instructions we should not be here now to talk about it." The writer then adds that although he could not ask the captain to explain, still he "felt that at a critical moment his thorough seamanship had inspired him to do something which contravened official orders for such emergencies, but had saved their lives." I think those who have read his account of that collision, brief as it was, and also the commander's reply to him on this occasion, will almost doubt whether he realises that such an article as Art. 23 exists in the "International Steering and Sailing Rules," for if he did, I could hardly imagine him making use of such a sentence as the above.

Several years afterwards, the writer tells us, he was standing on the pier at Halifax, seeing some friends off. As the Cunarder *Alpha* shot out into the stream, he was asked by a friend (a shipowner), "What course will that steamer take when her helm is put to port?" The answer given by the friend was, "The stern of the vessel will be deflected to the left, and not the bow, which moves around in the direction you suppose." On observation, the writer says he found this to be correct.

In this, to a great extent, I agree with the writer that there is a considerable amount of deflection of the stern, consequent on the ship's answering her helm, and, so to speak, moving on a pivot placed amidships; but I do not think he is right in saying that it is the stern and not the bow that is deflected, for with a steamer going full speed ahead through the water and turning on her helm, the

deflection of the bow naturally deflects the stern also. Then, again, has the writer taken into account whether his examples were paddle or screw steamers? and if screw, whether they were right or left handed, and whether in either instance the engines were eased or reversed to facilitate the turning of the ship? For the subject of the "action of the rudder upon steamers" can only be discussed jointly with the action of the screw on the ships, and in doing so it will be necessary to take an example where the ship is not under the influence of any current.

The next example given is the collision between the German ironclads *Grosser Kurfürst* and *König Wilhelm*. I refrain from commenting on this case, but would again add, Is the writer sure that the engines in either of these ships were not stopped or reversed? My reason for passing no remarks on this collision is because I do not recollect the facts of the case.

With reference to the collision between the *Stonington* and *Narragansett*, it is stated that both ships were approaching head on at great speed, and that the rule of the road was followed by both ships. Still they collided.

It seems to me that if in this case the rules and regulations were followed, it was done in a way not in strict conformity to the above rules, insomuch that it must have been left till too late, for we are told "there was not sufficient interval to allow for the stern deflection."

The rule of the road allows every officer in charge of a ship to exercise a certain amount of discretion, and this would expect both ships to have altered their course in good time, so as not to have had to put the helm hard over at the last moment, which appears to have been done. Of course this would be altered if it was thick weather, and the putting of the helm hard over would perhaps be unavoidable; on the other hand, if it was thick, they were most emphatically disobeying all rules by going at "great speed" in such weather.

In the writer's last example of a collision in the *Oregon*, he even goes so far as to show by diagrams that a collision would have been avoided if the *Oregon* had starboarded. I quite agree with this example of his; but to say that it would have been directly disobeying the rules and regulations &c. would be absurd. I can only think that if he has read the rules for preventing collisions at sea now in use he has not thoroughly grasped their meaning, and has missed Art. 23 altogether.

Of the steamer leaving a wharf in Toronto Bay, which was carefully lined by means of a stationary object, and which was found to be bodily deflected to the left when the helm was ported, I can only say that she, too, was most probably brought under the influence of a broadside current when her helm was being altered, and if not, will the writer inform me how it is that if a right-handed screw steamer is going full speed or any other uniform speed through the water ahead, and the helm is put hard over either way, the ship will describe a perfect circle, coming back to her former position exactly, always providing there is no current? I have seen this tested several times, and never known a ship out half her breadth.

I am sorry that any one should think that such able regulations as those provided by Government, not only of this country, but of all other civilised countries, and which are called "The International Steering and Sailing Rules" should require modification. I believe the writer is not alone in thinking so, but I can only say that in fifteen years' experience, ten of which have been in some of the finest steamers of England's mercantile marine, I have had cause to see these regulations well tried, and in cases where collisions have almost been inevitable, and in collisions themselves, I have never yet found the said regulations at fault, but always found, where used with discretion, that any seaman, whoever he may be, can put his whole trust in them. Of course, they cannot provide against the reckless use of the helm (as it is too often used) through which so many collisions occur; no regulations, whatever they might be, could do so. At the same time I firmly believe that any seaman who carefully carries out these rules, not thinking only of one, but taking all into account (including Art. 23), need never be afraid of losing his certificate through a collision, and in most cases will save his ship and all hands by adhering to them.

DARWIN'S LIFE AND LETTERS.

(*Concluded.*)

DARWIN worked at his rough notes on the variation of animals and plants under domestication, adding facts collected by "printed inquiries, by conversations with skilful breeders and gardeners, and by extensive reading," but still groping in the dark as to the application of selection to organisms living in a state of nature, until, as we have seen, the chance reading of Malthus suggested a working theory. A brief sketch of this theory, written out in pencil in 1842, was elaborated in 1844 into an essay of 230 pages, the importance attached to which is shown by a letter which Darwin addressed to his wife, charging her, in the event of his death, to apply 400*l.* to the expense of publication, and suggesting certain competent men from whom an editor might be chosen, preference being given to Sir Charles (then Mr.) Lyell, with whom he was on specially intimate terms and under much indebtedness—indeed, his acceptance of the uniformitarian theory of the "Principles" put him on the right track.

The correspondence between Darwin and Sir J. Hooker* in the earlier part of the second volume throws a flood of light on the collection and weighing of the materials for the future book, especially those supplied by the facts of geographical distribution; but, passing this over as difficult of condensation, we find that, acting on Lyell's advice, Darwin began to write out his views on a scale three or four times as extensive as that in which they appeared in the "Origin of Species." Happily, their publication was hastened by the well-known incident of the receipt of a paper in June 1858 from Mr. Alfred Russel Wallace, who was then in the Malay Archipelago, which "contained exactly the same theory," and which was accompanied by a request to Darwin, if he thought well of the essay, to send it to Lyell for perusal. This Darwin did forthwith, writing as follows:—

> Your words have come true with a vengeance—that I should be forestalled. . . . I never saw a more striking coincidence; if Wallace had my MS. sketch written out in 1842, he could not have made a better short abstract! Even his terms now stand as heads of my chapters. Please return me the MS., which he does not say he wishes me to publish; but I shall, of course, at once write and offer to send to any journal. So all my originality, whatever it may amount to, will be smashed, though my book, if it will ever have any value, will not be deteriorated, as all the labour consists in the application of the theory.

Darwin, as subsequent letters show, came out well in this business. For to have hit upon a theory which interprets

* This extract is especially interesting as "marking time": "I have read heaps of agricultural and horticultural books, and have never ceased collecting facts. At last gleams of light have come, and I am almost convinced (quite contrary to the opinion I started with) that species are not (it is like confessing a murder) immutable." Letter, January 11, 1844. Vol. II., p. 23.

so large a question as the origin and causes of modification of life-forms, to keep on turning it over and over again in the mind for twenty long years, to spend the working-time in every day in collection and verification of facts for and against it, and then to have another man launching a "bolt from the blue" in the shape of a paper with exactly the same theory, might well disturb even a philosopher of Darwin's serenity.

However, both Hooker and Lyell had read his sketch a dozen years before, and it was arranged by these two friends, not as considering claims of priority, which have too often been occasion for unseemly wrangling, but in "the interests of science generally," that an abstract of Darwin's MS., together with his letter to Asa Gray, should be read with Wallace's paper at a meeting of the Linnean Society, July 1, 1858. Sir Joseph Hooker says, in a letter to Mr. Francis Darwin: "The interest excited was intense, but the subject was too novel and too ominous for the old school to enter the lists before armouring. After the meeting it was talked over with bated breath. Lyell's approval, and perhaps in a small way mine, as his lieutenant in the affair, rather overawed the Fellows, who would otherwise have flown out against the doctrine. We had, too, the vantage-ground of being familiar with the authors and their theme."

Nothing can deprive Mr. Wallace of the honour due to him as the co-originator of the most important theory of our time, and in connection with this it is due to him to quote his self-effacing remarks in the preface to his volume of essays, as also Darwin's just tribute to him on its publication:—

> The present work will, I venture to think, prove that I both saw at the time the value and scope of the law which I had discovered, and have since been able to apply it to some purpose in a few original lines of investigation. But here my claims cease. I have felt all my life, and I still feel, the most sincere satisfaction that Mr. Darwin had been at work long before me, and that it was not left for me to attempt to write the "Origin of Species." I have long since measured my own strength, and know well that it would be quite unequal to that task. Far abler men than myself may confess that they have not that untiring patience in accumulating and that wonderful skill in using large masses of facts of the most varied kind—that wide and accurate physiological knowledge—that acuteness in devising and skill in carrying out experiments, and that admirable style of composition at once clear, persuasive, and judicial—qualities which, in their harmonious combination, mark out Mr. Darwin as the man, perhaps of all men now living, best fitted for the great work he has undertaken and accomplished.*

Darwin's words are as follows:—

> There has never been passed on me, or, indeed, on any one, a higher eulogium than yours. I wish that I fully deserved it. Your modesty and candour are very far from new to me. I hope it is a satisfaction to you to reflect—and very few things in my life have been more satisfactory to me—that we have never felt any jealousy towards each other, though in one sense rivals. I believe I can say this of myself with truth, and I am absolutely sure it is true of you.

Mr. Wallace modestly, but correctly, assesses his powers, and his subsequent entanglement in the meshes of spiritualism, combined with his hesitation to apply the theory of evolution to man in his *tout ensemble*,† make us thankful that the working-out of the details of the theory of natural selection was left to Darwin alone.

Shortly after the Linnean meeting Darwin set to work to prepare a series of papers which, always regarded by him as an "Abstract," ultimately took book form, and was published under the title of the "Origin of Species" in November 1859. In his own crisp, clear English, Professor Huxley describes the reception of that book, adding some interesting autobiographical matter, and we commend the reading of his chapter to a generation which, drinking in Darwinism from its birth, may learn with surprise what a storm and outcry both in clerical and scientific quarters its publication raised. "In fact," the Professor says, "the contrast between the present condition of public opinion upon the Darwinian question; between the estimation in which Darwin's views are now held in the scientific world; between the acquiescence, or at least quiescence, of the theologians of the self-respecting order at the present day and the outburst of antagonism on all sides in 1858–59, when the new theory respecting the origin of species first became known to the older generation to which I belong, is so startling that, except for documentary evidence, I should be sometimes inclined to think my memories dreams." *

As far as the larger number of naturalists and of the intelligent public who followed their lead were concerned, there was an absolutely open mind to receive a sufficing explanation of the mutation of species. There had been a long time of preparation and speculation. Evolution in one form or another is as old as Pythagoras and Empedocles, but although Herbert Spencer had removed it from the empirical stage at which it had remained for more than two thousand years, and placed it on an inductive base broad as the facts by which it was supported, and although Emerson, seer-like, felt it to lie at the heart of things, it was not in touch with the age until Darwinism gave it that practical form and human interest by which it could be seized on and applied in a concrete way. Dissertations on the passage of the homogeneous to the heterogeneous; explanations of the theory of the evolution of complex sidereal systems out of diffused vapours of seemingly simple texture, interested people only in a vague and wondering fashion, but when Darwin illustrated development by familiar illustrations gathered from his observations and experiments, and from intercourse with breeders of pigeons, horses, and dogs, and applied these to the question of the variation of life-forms, this went to men's "business and bosoms," and if the vulgar interpreted Darwinism as the explanation of man's descent from a monkey, or of the whale which was once a bear that had taken to swimming, the thoughtful accepted it as the master-key that unlocked the long-hidden mystery, not of origins, nor of the causes of variations, nor of heredity, but of the great agent, natural selection, which, operating on favourable variations, has brought about myriads of species from simple forms.

Among the men of "light and leading," Hooker, Huxley, Bates, and Sir John Lubbock were immediate converts, so were Lyell and Asa Gray, but with reservations; Henslow and Pictet went one mile, but refused to go twain; Agassiz, Murray, and Harvey would have none of the new doctrine; neither would Adam Sedgwick, who wrote a long letter of protest to Darwin, couched in loving terms, and ending with the hope that "we shall meet in heaven," while the unsatisfactory and "hedging" attitude of Professor (now Sir Richard) Owen is matter of history, as are the two pitched battles at the Oxford meeting of the British Association in 1860, immortalised by Huxley's annihilating rejoinder to Bishop Wilberforce's question as to the Professor's lineal relationship to an ape. But "the Lord was not in the earthquake," and the rumblings soon ceased, to be awakened for a little while when the "Descent of Man" was published. The first shock over, the timid were reassured, and, when the theologians, finding, like the Empress Helena in search of the true cross, what they looked for, saw anticipa-

* "Contributions to the Theory of Natural Selection." Macmillan & Co. 1870.

† In a letter to Wallace, April 14, 1869 (vol. iii., p. 116), Darwin says:—"As you expected, I differ grievously from you, and I am very sorry for it. I can see no necessity for calling in an additional and proximate cause in regard to man. But the subject is too long for a letter."

* Vol. ii. p. 181.

tions of the nebular theory and of the successive advance in life-forms in the first chapter of Genesis, and in the preparation for Christianity in Judaism, the more liberal among them welcomed the new evangel, and told us in their artless way that they knew it all before! Well had they kept the secret.

It is often said that a man's religion concerns himself only. So far as the value of the majority of people's opinions on such high matters goes, this is true; but it is a very shallow saying when applied to men whose words carry weight, or whose discoveries cause us to ask what is their bearing on the larger questions of human relations and destinies to which past ages have given answers that no longer satisfy us, or that are not compatible with the facts discovered. Whatever silence Darwin maintained in his books as to his religious opinions, intelligent readers would see that unaggressive—and wisely so, for the immediate work in hand—as was the mode of presentment of his theory, it undermined current beliefs in special providence, with its special creations and contrivances, and therefore in the intermittent interference of a deity, excluding that supernatural action of which miracles are the decaying stock evidence.

Nor could they fail to ask whether the theory of natural selection by "descent with modification" was to apply to the human species. And when Darwin, already anticipated in this application by his more daring disciples, Professors Huxley and Haeckel, published his "Descent of Man," with its outspoken chapter on the origin of conscience and the development of belief in spiritual beings, a belief subject to periodical revision as knowledge increased, it was obvious that the bottom was knocked out of all traditional dogmas of man's fall and redemption, of human sin and divine forgiveness. Therefore, what Darwin himself believed was a matter of moment, and his answers to inquiries which were made public during his lifetime told us what we expected, that while the varying circumstances and modes of life made his judgment often fluctuate, and that while he had never been an atheist in the sense of denying the existence of a God, "I think," he says, "that generally (and more and more as I grow older) but not always, an agnostic would be the most correct description of my state of mind." The chapter on "Religion," which, although a part of the autobiography, is printed separately, adds little to this bit of information—we were about to say this *confessio fidei*; but it is, as the following quotation shows, interesting as detailing a few of the steps by which Darwin reached that suspensive stage.

> Whilst on board the *Beagle* I was quite orthodox, and I remember being heartily laughed at by several of the officers (though themselves orthodox) for quoting the Bible as an unanswerable authority on some point of morality. I suppose it was the novelty of the argument that amused them. But I had gradually come by this time—*i.e.* 1836 to 1839—to see that the Old Testament was no more to be trusted than the sacred books of the Hindoos. The question, then, continually rose before my mind, and would not be banished—is it credible that if God were now to make a revelation to the Hindoos he would permit it to be connected with the belief in Vishnu, Siva, &c., as Christianity is connected with the Old Testament? This appeared to me utterly incredible.
>
> By further reflecting that the clearest evidence would be requisite to make any sane man believe in the miracles by which Christianity is supported—and that the more we know of the fixed laws of nature the more incredible do miracles become—that the men at that time were ignorant and credulous to a degree almost incomprehensible by us, that the Gospels cannot be proved to have been written simultaneously with the events, that they differ in many important details, far too important, as it seemed to me, to be admitted as the usual inaccuracies of eye-witnesses; by such reflections as these, which I give not as having the least novelty or value, but as they influenced me, I gradually came to disbelieve in Christianity as a divine revelation. The fact that many false religions have spread over large portions of the earth like wildfire had some weight with me.
>
> But I was very unwilling to give up my belief: I feel sure of this, for I can well remember often and often inventing day-dreams of old letters between distinguished Romans, and manuscripts being discovered at Pompeii or elsewhere, which confirmed in the most striking manner all that was written in the Gospels. But I found it more and more difficult, with free scope given to my imagination, to invent evidence which would suffice to convince me. Thus disbelief crept over me at a very slow rate, but was at last complete. The rate was so slow that I felt no distress.
>
> Although I did not think much about the existence of a personal God until a considerably later period of my life, I will here give the vague conclusions to which I have been driven. The old argument from design in Nature, as given by Paley, which formerly seemed to me so conclusive, fails, now that the law of natural selection has been discovered. We can no longer argue that, for instance, the beautiful hinge of a bivalve shell must have been made by an intelligent being, like the hinge of a door by a man. There seems to be no more design in the variability of organic beings, and in the action of natural selection, than in the course which the wind blows. But I have discussed this subject at the end of my book on the "Variation of Domesticated Animals and Plants," and the argument there given has never, as far as I can see, been answered.

Without doubt, the influence of the conclusions deducible from the theory of evolution are fatal to belief in the supernatural. When we say the supernatural, we mean that great body of assumptions out of which is constructed all theologies the essential element in which is the intimate relation between spiritual beings, of whom certain qualities are predicated, and man. These beings have no longer any place in the effective belief of intelligent and unprejudiced men, because they are found to have no correspondence with the ascertained operations of nature, which may or may not be the vehicles of Mr. Spencer's "Infinite and Eternal Energy," but which are not due to the fictitious demiurges of the type created by Kepler to account for the movements of the planets. The supernatural, or the natural—for from our standpoint the term matters little—remains unexplained. Darwin says, "I cannot pretend to throw the least light on such abstruse problems. The mystery is insoluble by us, and I for one must be content to remain an Agnostic." In the chapter already referred to, Professor Huxley says, "In respect of the great problems of philosophy, the post-Darwinian generation is, in one sense, exactly where the pre-Darwinian generations were. They remain insoluble. But the present generation has the advantage of being better provided with the means of freeing itself from the tyranny of certain sham solutions."* Science may borrow the Apostle's words, "Behold! I show you a mystery," and give to them a profounder meaning as it confesses that the origin and ultimate destiny of matter and motion; the causes which determine the behaviour of atoms, whether they are arranged in the lovely and varying forms which mark their crystals, or whether they are quivering with the life which is common to the amœba and the man; the conversion of the inorganic into the organic by the green plant, and the relation between nerve-changes and consciousness; are alike impenetrable mysteries.

There is no finality in science, but when we reflect how the major number of problems suggested by the universe, regarded only from a mechanical standpoint, have one by one been solved by the intelligence of man, the thought sometimes arises that the limits of knowledge may be reached, and that little remains to be discovered within the domain of the phenomenal beyond the filling-in of details; that, as an eminent astronomer who has proved the star-depths, and read the message of the most distant light-bringers known, remarked some time ago to the present writer, "the cream has been skimmed." The discoveries of the law of gravitation, of the distribution

* Vol. ii. p. 204.

and like chemical elements of the heavenly bodies, of the distance and size of large numbers of them, of the molecular constitution of matter, of the conservation of energy, of the fundamental identity of stuff in sun and planets and in all life-forms, and finally, of the mighty processes which have evolved the not-living and living totality of the universe from a diffused mass of vapour;—these are the triumphs of the human intellect, and now, perchance, it may not do amiss if it turn aside for a time to problems which are less remote, and in the solution of which the heart must play a large part—namely, the redress of social ills which make the "struggle for life" more severe among civilised races than among barbaric races and the lower animals.

Edward Clodd.

THE ORIGIN OF MAN.

Professor Max Müller has just brought out his "Science of Thought," the true object of which is to show that thought is an aspect of language, whatever that mysterious statement may mean. Fortunately Professor Müller explains at the outset that it really matters little or nothing whether we regard thought as he does or as men have hitherto regarded it——that is, as a process relating to objects, attributes, and acts, whose working cannot proceed without language of some sort. If ever Professor Müller's idea is established thought will go on just as it did before; or, as he himself puts it, "we should remain in every respect exactly as we were before, we should only comprehend our inner workings under new and, I believe, more correct names."

But Professor Müller has further undertaken in this new-old work of his to renew his attack on the general theory of biological evolution (of which the Darwinian theory is but a part), an attack which had considerable interest fourteen years ago, but is now wholly out of date. It is not to deal with Müller's worn-out objection that articulate speech separates man absolutely from all animals that I am now about to write of Müller and Darwin; but as Müller represents a type of anti-Darwinians which is very wide-spread, I propose to consider here the strange misapprehensions into which he and others of his type have fallen respecting the doctrine of biological evolution, which in its general form is now universally accepted by all whose opinion can reasonably be regarded as of any weight.*

The fatal error—fatal at least so far as understanding evolution is concerned—into which Max Müller and most other anti-Darwinians fall, is that of supposing that the modern biological doctrine of the origin of man regards the human race as descended from a single pair. "Popular scientific opinion now," says Müller (meaning, as the context shows, the ideas generally accepted as the teaching of leading biologists), "is decidedly in favour of one primitive pair of human parents—nay, it hankers for one primordial ancestor for all ancestors, and in the end for all organic beings."

If Professor Müller had said that this was the common misinterpretation of the teachings of Darwin and of Darwin's co-workers and followers, he would have been near the truth. Darwin speaks repeatedly of the ape-like progenitor of the human race, of man's anthropoid ancestor, and so forth; and his fellow-workers and followers have used similar expressions. Again, Darwin and the Darwinians speak of the probability that the primordial forms from which animal and vegetable life sprang may have been very few—four or five, perhaps—perhaps fewer—perhaps even but one. Probably Darwin and his followers have never conceived it possible that this way of speaking could be misunderstood.

Yet very soon after the "Origin of Species" was written, in which the descent of man from the brute creation was barely hinted at, the unscientific world began to picture a pair of gorillas instead of Adam and Eve as the progenitors of man; and a host of unknowing ones began to ask whereabouts the four or five bits of protoplasm appeared on the earth from whom the whole stream of life upon our globe has descended. The mistake is such an absurd one that, resulting as it does from the literal interpretation of Darwin's words, one rather wonders those words were not read more literally still, in which case the first and most obvious objection to be urged against the Darwinian theory would be that it makes man descend from a single progenitor, not from a pair, and descent from a single progenitor is very difficult to comprehend. Absurd as this is, descent from a single pair is, for one who knows anything about biological laws, altogether as difficult to accept as descent from a single ancestor, whether male or female.

But the fact is that no one who has studied Darwin's chief works (valuable almost as much for what they teach respecting evolution generally as for what they teach respecting the Darwinian theory) can for a moment imagine that *any race whatsoever* has sprung from a single pair, or even from a small number of progenitors. When he speaks of an ancestor, he means always an ancestral race. The ancestral anthropoid ape, for example, is not a single ape or a single pair, but that particular race of apes whose qualities, combined with the qualities of their environment, and eventually modified by the varying conditions of that environment, resulted in progressive changes by which the lowest race or races of man were developed.

The question as to the single or multiple origin of man which has been discussed among biologists has not been whether man descended from one pair or from many thousands of pairs, but whether the present races of man all descended from one race of anthropoid apes or from several such races. On this last point there is room for discussion; on the former none. Any one who considers the striking resemblance between certain of the least lovely among the African negroes and those unlovely African apes—the gorilla and the chimpanzee—will be disposed to credit some of the African tribes with descent from a race of African apes akin both to the gorilla and to the chimpanzee, but with superior opportunities of development toward the man-like type. In like manner the orang-outang and the gibbon ape may be regarded as nearer akin to the anthropoid ancestors of the aboriginal inhabitants of the East Indian Islands than any other apes now known to us. The ancestral apes from whom the savage progenitors of the Aryan, Semitic, and Turanian races were descended, seem to have left no descendants, nor have any of their near kindred; but the time may one day come when their fossil remains will be detected.

Possibly, if recent suggestions respecting the origin of the Aryan races may be accepted, we shall find the fossil ancestors of our own division of the human family in Finland. But it may well be that, as is urged by many Darwinians, the race whence gorillas and chimpanzees, orangs, gibbons,

* It is from no want of respect for Müller, whose position in his own scientific department is very high and thoroughly merited, that I include him among those whose opinion about Darwinism has no weight; it is simply because, like others of his type, he has not cared to make himself acquainted even with the elementary details of the theory he rejects. He is in that respect like a clerical person who, being asked by a friend of mine if he had carefully studied certain writings he had been enthusiastically objurgating, replied earnestly, "Thank God, I have never even seen them!"

and other anthropoid apes, including the progenitor of ancestral savage man, were developed, was one; and these diverse forms resulted from the effects of environment and natural selection leading to the survival of the fittest.

In any case we must remember this, that even if we regard men and existing apes as directly descended from a common ancestral race, we must recognise not merely the probability but the certainty that all the races of apes have changed as much from that ancestral type as man has, or as have all races of men if we regard Caucasian, Semite, Nubian, Malay, and Polynesian as races having each their origin from some definite section of the primeval anthropoid stock. Even if the gorilla is the nearest among our ape cousins, it by no means follows that there have not been several races which—descended from the same common stock—would have been far nearer to man, had not circumstances led to their extinction. And whichever, even among such races, had been nearest to us if continued till now, would still probably have shown about twice the divergence which the common ancestral race had undergone on its progress towards man, since its progress towards that ape race (as it would now be) would have involved as much divergence in one direction as its progress towards man had involved in the other.

When we consider the real way in which Darwin regarded the development of a new race, and compare it with the way in which Professor Müller regards man as descended from a single pair, we shall recognise on the one hand the impossibility of a single pair being arrived at (except in a dying-out race), and on the other the impossibility of a single pair, even if of the most stalwart frame and of the soundest constitution, becoming the progenitors of a thriving race.

A new race is only developed when an old race which has perhaps continued long without change is exposed to new conditions, owing to some change in the environment. Then, and then only, comes into action the principle of the survival of the fittest (for when the conditions have long been unchanged, the bulk of the community are well fitted to survive). Now the very nature of the doctrine of the survival of the fittest requires that there should be many of the more fit or less fit, or of the more or less unfit, on whom the environment should exert its selective influence.

Observe that if the influences of the environment are too searching, the fittest indeed survive, but those thus fit are few, and at each successive generation the total number diminishes until extinction ensues. On the way towards such extinction there might well be at last only one pair left; but assuredly that pair would not save the race from extinction. The fact that a race once numerous had dwindled to a pair would suffice to render the extinction of the race certain. But when the influences of the environment, though potent, are not destructive, the numbers of the race, though they may be affected at first, are not diminished in the long run; and so soon as the process of development, whatever it may be, which is necessary to fit the race for its surroundings, has been accomplished, the race will begin to increase and thrive. So that the modified race resulting from the principle of natural selection will be numerous and thriving even at the beginning of its career, and grow more numerous while the conditions remain unchanged, to be again sifted out in some degree with further change in the developments, yet always eventually to grow and thrive—progressing towards greater and greater correspondence with its altered environment.

So much is true of all races developed by the process of natural selection. Many races necessarily perish in the process. But the principle of the survival of the fittest applies to races as to individuals. And so far as the biological problems actually before us are concerned, we have to consider only the races which *have* survived, not those which have died out.

Taking man, a race which, whether his origin was single or multiple, has most assuredly survived, we see that, whatever the conditions under which that particular race or those particular races which preceded savage man existed, there arose in some way a struggle for existence through changes in the surrounding conditions. This struggle caused some anthropoid creatures, very great in number, very thriving in habitudes, and well fitted to withstand change, to undergo marked development through the operation of natural selection, in such sort as to become men—uncouth, cave-dwelling, tree-climbing—in fine, savage, but still very certainly men. Besides those qualities, absolutely essential to their survival, the primeval anthropoids from whom man descended must have been very numerous, whether they belonged to one race and were to give birth to all varieties of men, or to several races, and were to give birth severally to several distinct human races. Not otherwise can a healthy, thriving offspring-race be even imagined, except by the operation of miracle, which science (never seeing miracles in operation) very properly and completely rejects.

Thus, while a numerous and a healthful race was reached before man began, from which race man was to be developed—not by the dying out of all save a pair, but by the survival of the fittest by hundreds of thousands—since the descent of the human or any other race from a single pair is, in fact, entirely inconsistent with all which experience has taught us—man may have descended from one ancestor, meaning one ancestral type, or from several, as is in my judgment (viewing the matter mathematically) altogether the more probable. But that man can have descended from a single pair is disproved doubly, first by the fact that, along the line of biological descent under crucial conditions of environment, no single healthful pair can ever have been reached, and secondly by the circumstance that if a healthful pair were artificially selected (all other members of the race being destroyed) to start a race, no healthy race could possibly descend from them (excepting always by miracle).

And now having attained a stage where some advanced form of anthropoid ape is likely to undergo a marked process of development, not necessarily including the acquisition of some kind of language, we see how the developing race might, as the very condition of their existence, have to form societies for mutual protection. Men, even in the beginning of their existence as such, and therefore their immediate progenitors, can never have been physically comparable with surrounding races. I am aware that the gorilla *is* so comparable; but that shows merely how *he* has diverged from the ancestral ape from whom man descended. Along the human line of descent social qualities were developed as essential to successful existence: the gorilla and kindred apes have made their successful struggle for strength through mere strength; and probably they have paid for it by a process of intellectual degradation as marked as the process of intellectual elevation by which their kinsfolk, men, have secured survival, and eventually thriving survival by social interrelations.

Imagine, then, a race of arboreal apes, weaker and gentler than the gorilla or orang-outang (even than these probably were before their present powerful frames were developed), and suppose such a race exposed to a struggle for existence constantly increasing in stringency, owing to the development of swift and strong carnivorous races around them, or in their midst. We may even perhaps imagine, further, the gradual retreat of this race of Pithecanthropoids, or ape-

men, from their forest domain to regions less densely wooded, and where they would soon be driven to seek shelter from the weather and from their enemies in caves, or to dig out sheltering homes in such places as they found suitable. To such a race, so circumstanced, three things would be chiefly necessary for safety- (1) the development of such reasoning powers as so advanced a race of apes may be fairly supposed to have possessed, since even the apes which have survived to our time, chiefly through mere brute strength, possess some reasoning power; (2) the development of the habit of using such weapons of defence as stones and sticks, which would involve a tendency not so much to the bipedal as to the bimanous condition; and (3) the development of such means of communication among themselves as would enable them to act in concert against their enemies, to give warning of the foe's approach, to give the signal of attack upon him, and when necessary to give suitable note of preparation for properly manœuvred retreat.

These necessities of a race so circumstanced are precisely such as the Darwinian theory regards as essential for the development of the required qualities. Those among the race who were dullest of apprehension, or least ready to make up by the use of sticks and stones for their naturally defenceless condition, or least prepared to make or to understand signals, vocal or otherwise, would inevitably fall victims in greater numbers to the attacks of their various enemies than those who were quick to reason, ready with their hands, and apt at signalling. Probably even the influence of weather would tend to destroy more of those who were inferior in the qualities considered than of those who excelled in them.

The dying out of the inferior in greater numbers would necessarily lead to the constant development of these qualities in higher and higher degree—natural selection operating as certainly in this respect as artificial selection, though more slowly.*

That reasoning powers far in advance of those possessed by the most intelligent apes of to-day might be thus developed by the continual selection of the cleverer members of a family and the dying out (relatively) of the less apt and ingenious, can scarcely be doubted when we consider how under artificial selection the intelligence of many classes of animals has been increased. That readiness in the use of the hands and a gradually increasing aptitude for going on two feet would also be developed, corresponds, of course, with what we know even of those apes which have had comparatively small occasion for handiness in the use of weapons or missiles.

Professor Müller and others deny the possibility of any sort of language being developed from such systems of signalling and intercommunication as would be necessary among a race of apes circumstanced as we have supposed. Yet when met by the evidence that the man of Neanderthal was almost certainly mute, Professor Müller admits that non-speaking men developed into men with the power of speech; and no difficulties in the problem of the development of speech from non-speaking animals on their way to fully speaking men are greater that we recognise when we consider the development of man as he is to-day from the unspeaking men of La Naulette. Observe, also, that the non-speaking ape did *not*, it appears, develop into speaking man, but into a mute creature lower than the lowest savage of our own time. The development of speech came after the development of man from the ape.

Professor Müller's argument that apes do not now develop speech has, then, no weight whatever, since no race of apes seems ever to have developed into speaking man, but only into a race of mute savages, such as the men of Neanderthal. Besides, the most advanced apes of to-day have probably degenerated in intelligence from their ancestry, while even those their more intelligent and less brutal ancestry were less intelligent and more brutal than the contemporary ancestry of man.

* Professor Müller strangely enough speaks of "natural selection" as a mere name, nowhere inquiring whether the sorting out of certain members of a race indicated in the Darwinian theory actually takes place or not, but entering into a preposterous argument about the word "selection" implying reasoning. It would be as reasonable, when a physicist speaks of the selective absorption of the spectroscope, to inquire not into the facts presented for consideration, but into the question whether a spectroscope can properly be said to select, which involves reason.

METEORIC COSMOGONY.

THE following letter appeared in the *Times* of December 22:—

I am not on my own account apt to be concerned by questions of priority, which indeed seem to me always somewhat puerile; but there is so much in the general theory advanced in the *Times* of November 18 as Mr. Lockyer's which has been for years the common property of science, that I must not allow my own accidental connection with a portion of the subject to prevent me from calling attention to the just claims of others.

The researches of Mayer, Thomson (Sir William), Helmholtz, and others involve (implicitly, if not, as in some cases, explicitly) the theory of the formation of systems like our solar system by processes of meteoric aggregation. I pointed this out in the preface to the first edition of my "Other Worlds," dated May 1870, noticing at the same time, I think fairly, that the line of reasoning followed in the chapter on "Comets and Meteors" in that work is new. (Five years before, in the preface to my "Saturn and its System," I had touched on the processes of aggregation by which, as distinguished from the processes of simple condensation imagined by Laplace, the solar system appears to have been formed.) In particular, I there showed that all the peculiarities of arrangement within the solar system find an explanation in the meteoric theory, while they are left absolutely unexplained by the nebular hypothesis.

But in reality the meteoric theory can only be accepted as based on multitudinous researches, astronomical, physical, and chemical, such as Mayer, Thomson (Sir William), Sorby, Graham, Dewar, Daubrée, Meunier, Tschermak, Helmholtz, Wright, and Newton (both of Yale College), and others have made, combined with spectroscopic researches like those of Secchi, Miller, Huggins, Vögel, and others. Doubtless in the paper read before the Royal Society Mr. Lockyer must have made some important contribution to one or other of these departments of research. In the voluminous report, however, which appears in the *Times* for November 18 I find only as novel the announcement that meteorites already known to contain the same elements as the sun and the stars can by suitable selection be made to give similar spectra. This, of course, was antecedently certain.

It is, however, satisfactory to find the theory of meteoric aggregation supported as warmly by Mr. Lockyer as the theory of Professor Clarke, of Cincinnati, respecting the compound nature of the so-called elements. Such support affords strong evidence that the theory is growing in public favour, as well as in the approval of men of science.

Believe me, faithfully yours,

RICHARD A. PROCTOR.

Corona Lodge, Orange Lake, Florida: Dec. 9.

Gossip.

By Richard A. Proctor.

A correspondent kindly sends me the following cheerful note:—

I have been in communication with a competent authority upon the subject of the assertions respecting Osiris and Horus made by you in Knowledge for October 1886, p. 346. This gentleman (*sic!*) says of these remarks: "The statement in question is utterly false. It is not founded upon a mistake, but is a deliberate fraud—which can hardly be called a *pious* one. It is a lie, and nothing else." Further on in his letter he says: "The writer" (I did not name you, sir, nor your magazine) "of the passages quoted is a deliberate liar, and there is no other judgment to be passed upon him."

As I am anxious to examine the evidence adduced by you for myself, I should feel greatly obliged if you would furnish me with your authorities. The statements I wish verified are that Osiris and Horus were virgin-born; that a star appeared in the east on December 25; that Osiris was at that time exhibited in effigy (will you please give the exact reference to the "Chronicles of Alexandria"); and that Horus was worshipped at Christmas time. I may also add that I have been unable to find the name of Pigord, from whom you quote in the foot-note, in any biographical dictionary. These particulars would, dear sir, be very acceptable.

* * *

I regret much that I am unable to give my polite correspondent the exact reference to the "Chronicles of Alexandria," a work which I do not possess, and believe to have been non-existent—save in certain passages by ancient authors—for many centuries. Mr. Bonwick, who refers to the Chronicles in his "Egyptian Belief and Modern Thought" (published by Kegan Paul & Co.), see pp. 143 and 157, may be able to tell my correspondent more on this point. Rigord (misprinted Pigord) is quoted by Higgins in his "Anacalypsis," vol. ii., p. 102. As another authority I would name M. Le Clerk de Septelemes's "Religion of the Ancient Greeks," p. 214, where it is mentioned that the ancient Egyptians fixed the pregnancy of Isis (the Queen of Heaven, and Virgin Mother of the Saviour Horus) in the last days of March, and assigned the commemoration of her delivery to the last day of December. For the star, see article in this number on the "Star of Bethlehem."

* * *

As for the virgin birth of both Horus and Osiris, it has been universally admitted that Isis, the mother of Horus, and Neith, the mother of Osiris, were virgin goddesses; Seb, the father of Osiris, was simply the celestial fire, and Osiris in turn only in a mystical sense and as Deity the parent of Horus. Both Horus and Osiris are called "self-begotten" as well as "virgin-born," their mothers being deities. I do not profess to be an authority, however, about such asserted processes, whether of self-conception or of incarnation. They cannot be regarded as belonging either to history or to exact science.

* * *

It has been suggested by Mariette Bey, as formerly by the Abbé Dupuis, that Osiris was the nocturnal sun, Horus the sun of day. Volumes might be written, indeed, about the various suggestions which have been made respecting the Egyptian deities. I should have to refer my correspondent to a whole library of books for full information on such points, but it is abundantly clear that both Osiris and Horus were solar deities, and, like all solar deities, regarded as virgin born, and brought forth at the time of the winter solstice—determined in each age by the heliacal rising of some special star—with a number of other details reproduced again and again in the histories of long-departed heroes or teachers, even when the original lives of these had had nothing to do with the sun's birth and death and resurrection. These are ascertained *facts*, be their interpretation what it may.

I had almost forgotten to refer to my correspondent's "competent authority's" personal comments. I am not sure whether they belong or not to the order of denunciation typified by the amusing curse, "May God confound him for his theory of irregular verbs." If this "competent authority" does not apply to me in this sense, and for some kindred no-reason, an amusing curse, he is at least, like Artemus Ward's kangaroo, "an amoosin' cuss" himself. My correspondent should cultivate his acquaintance—not, however, as an authority, but as an awful example. Hitherto (let me suggest very gently) my correspondent does not seem to have learned all that the warning example of this particular "Helot in drink" might have taught him; or he would hardly have quoted remarks so singularly rude, outside their absurdity, as "this gentleman's." He will doubtless be wiser one day.

* * *

In reply to a correspondent (Mr. J. E. Roose), *first*, I do not think the sun will ever be inhabited, but I do not know; *secondly*, the central orb of the universe, if such an orb there is, needs no centripetal force to keep it in its place, but I do not think there is such an orb, though here again I do not know; *thirdly*, I suppose when our system dies it will still obey the laws of gravity, seeing that a dead lion is as obedient to these as a live dog; and *fourthly*, I cannot tell why our earth's shining in past ages on an inhabited moon, if our earth ever did so shine, is to be represented "for the sake of argument" by "the reversed position" of a globe fifty times larger than ours (why larger?) shining upon the earth. There is, however, no "scientific opinion about the moon's having been inhabited," for "knowledge is of things we see."

* * *

I have received several interesting and valuable communications respecting Mr. Faith's article about "Collisions at Sea." One of these I published last month; another I publish this month; and I have still a third which will interest readers of Knowledge.

* * *

Americans of sense are relieved to find that those in their own country who took interest in Sullivan are matched by at least an equal proportion of persons in the old country taking interest in one who would be almost a match for a gorilla. Yet how much more interesting if the gorilla itself could be trained to pugilism!

* * *

The *Saturday Review* remarks of me in a recent issue that I do not love it, while—*Saturday Reviler* though it has been called by the profane—it dislikes nothing and no one. I dislike many things myself: among others, untruth and unfairness. But to dislike a paper or a magazine would be preposterous. I know enough of journalism to be able to distinguish an article written by a student and a gentleman from one written by a charlatan and a humbug, or from another written by a soured "old woman" of either sex, even though all three articles appear in the same paper. Averaging my ideas about the *Saturday Review* as I have had occasion to regard it personally, I have rather a liking for it, for I have had occasion to observe in its pages—(1) Pleasant and strong notices of my work; (2) pleasant, though unfortunately weak, notices; (3) unpleasant notices, useful as giving me an opportunity of correction (with or without use of the thong); and, lastly, some notices, so manifestly unfair or so femininely spiteful that they were their own severest corrective, and could do me nothing but good, whether noticed or left alone. [I personally very seldom adopt the affectation of "letting abuse alone"—I "go for it," as my American friends say, enjoying the work heartily, and striving to do it thoroughly.]

IN the Játakas, or Buddhist Birth Stories, so called because they narrate the exploits of the Buddha in the 550 births through which he passed before attaining Buddhahood, there is a story called the "Flight of the Beasts," which the recent ridiculous scare in Birmingham—the "Brummagem scare," as we may name it—calls to mind.

* * *

THIS Daddabha Játaka tells of a hare who, sitting under a cocoanut sapling, thought to himself, "If this earth were to come to an end, where should I be, I wonder?" At that moment a bilra-fruit fell upon a leaf of the sapling, and so startled the hare that he scampered away, thinking that the event was really happening. Another hare, seeing him run, and learning the cause, started off; then a third and a fourth hare took to flight without knowing the reason, and so on until one hundred thousand hares in like manner followed their example. Likewise all the other animals who saw them, asking the meaning, went at headlong speed, and as the Bodisat chanced to see them, and heard what fear caused their flight, he bethought himself how to save them from destruction. So rushing with a lion's speed, he outstripped them, and then roaring a lion's roar, so that they halted affrighted, he asked them why they ran. And the elephants replied that they knew not what was the sign of the end of the world, but that the lions knew; and in like manner one beast after another answered until they came to the hares, and last of all to the first hare, who told the Bodisat of the falling of the bilra-fruit. The Bodisat then took the hare on his back, and bounded along to the forest where grew the sapling, when, as it chanced, a bilra-fruit fell upon the sapling, and the Bodisat returned with the hare to the assembled beasts, whom he dispersed with words of comfort.

* * *

AT Birmingham the bilra-fruit fell in the shape of an astrologer's prophecy that dire things would happen on January 11 by reason of the conjunction of Mars and Uranus. The old women (were they, after all, hares enchanted for the nonce into human shape?) scampered to the police stations, and, failing to get support or comfort from the constables, clubbed their pennies together and bought Bibles. Others stayed in their beds, their faith in the prediction confirmed by the Cimmerian fog that enveloped the town. And this is A.D. 1888!

* * *

OUR readers may like to know that Messrs. Longmans announce the publication of Mr. Edward Clodd's "Story of Creation" in the early part of this month. The substance of the book appeared in this Journal, but the chapters have been revised and in great part rewritten, while the text has the advantage of being illustrated by numerous woodcuts and diagrams. The price of the book is six shillings.

Reviews.

The Sinclairs of England. (London: Trübner & Co. 1887.)—Notwithstanding his bad grammar and worse construction, it is impossible to be angry with the anonymous author of this book. His overwhelming enthusiasm for his subject is such as to disarm criticism. Was there ever, in the world's history, the equal of this Sinclair family of his? If so, it will have to be sought for in the Heroic Ages. Descended from Odin, god of the Dacians, a Frankish branch of the Sinclairs settles in Neustria, allies itself by marriage with the family of Norse Rollo "the Ganger," and takes high position in the new Duchy of Normandy. No fewer than nine of its members cross the Channel with their cousin, Duke William, and fight by his side at the battle of Hastings: eight of these are rewarded with possessions and earldoms all over the conquered country, and become founders of the Sinclairs of England; the ninth goes north, becomes Steward of Scotland (predecessor in office, and perhaps ancestor of the royal Stuarts), and ancestor of the Sinclairs of Scotland. As time goes on more Norman kinsmen crowd into England till there is hardly a noble family there with which they do not ally themselves. And now the climax of their greatness arrives. When Henry I. died the real heir to the English throne was—a Sinclair! In the eloquent words of the author, "Had fees not been partible, even to kingdoms, and had the Salique law been preserved (both solvents avoided in matters of private estate to wonderful extent), the monarch of England now would be of this lineage, as the legitimate heir to Henry I., the last male of the Norman dynasty on the throne. The Plantagenets, Tudors, and Stuarts were, on principles of just primogeniture and true male consanguinity, interlopers. Since Henry schemed for his daughter Matilda, the crown of England has been the prize of adventurers, and not too high type even of that class. The Fules, or Plantagenets, were a lot of Gallic robbers, not of the gallant Viking, but of the common thief complexion: the Tudors were the fruit of a *mésalliance* of a queen of England, daughter of a French mad king, to a little brewer of Wales (and they have left sufficient proofs of their Welsh low origin by essentially weak, cruel, immoral, Celtic tyrannical inefficiency, Elizabeth, the greatest by far of them, being, in all human, if not legal, probability, not Celtic at all, but an energetic English London Bullen): the Stuarts were underling, provincial, and upstart, in the exact meanings of those words; but the Scandinavian Rollo line were royal time out of mind, and their conquests have been all of the royal order. . . . Nothing better than, nothing equal to, them, has ever walked the globe." What a loss the English people have sustained without knowing it! After such a singular example of self-abnegation on the part of these Sinclairs, we are not surprised to find that the family has gradually died out in England until, at the present time, an English Sinclair is a rarity. But who will say that their history was not worth writing?

Uppingham School Songs and Borth Lyrics. By EDWARD THRING, Head-Master of Uppingham School from 1853 to 1887. (London: T. Fisher Unwin.)—*Addresses on Educational Subjects.* By the same.—These elegantly printed and bound books will be hailed with pleasure by the Old Boys of the school whose fame its great head-master made. Probably to them the chief interest will be in the poems and lyrics, which teem with memory-kindling references to the anxious time of the happy sojourn of the school at Borth—happy to the boys, anxious to the governors and head-master of the school, uprooted from its ancient home, and dropped as from the clouds on the western coast; but to the general public the Addresses are highly deserving of thoughtful perusal. Every schoolmaster and every schoolmistress should study what this great master taught. Ill could he be spared from a profession half educated, badly organised, or hardly organised at all, and without a definite belief in the importance of its work. Teachers are not minders, schools are not crèches, and the work done by the teacher is not represented in value by the salary paid for it. Thring was pre-eminently a man who estimated his profession highly. His ideal was high. He appears in these pages as he was; not a provider of certain doles of Greek or mathematics, with which, for a consideration, he furnished his pupils. He did not measure them with a Latin rule only. The complex entity known as a

boy, he maintained, has many sides; and he attacked him on all. No boy with an evident inaptitude for classics passed his school life on that account "under a cloud." Thring believed in finding out what the boy could do, and in seeing that he did that something well. In stimulating and guiding his clever boys, he did not neglect the dullards. "Stars imply a dark night around; and so it is oftentimes with the stars of a class." The Addresses abound with sparkling and keen allusions, and illustrations to points that should be in the minds of every teacher; and to those of this class who have their work at heart we cordially recommend these little volumes.

Serpent Worship and other Essays; with a Chapter on Totemism. By C. Staniland Wake. (George Redway.)—A great deal of nonsense has been written about Ophiolatry, and we regret to find that this book, which displays much industry in the collection of varied materials, is not a common-sense contribution to the subject. It is based upon discredited "authorities," and its conclusions are stale and fanciful. A really scholarly work upon what is an important department of animal worship is needed, and this Mr. Wake has not supplied.

The Creator, and what we may Know of the Method of Creation. By the Rev. W. H. Dallinger, F.R.S. (T. Woolmer.)—Dr. Dallinger's original investigations into the minutest life-forms have placed him in the front rank of microscopists, while his biological knowledge gives a value to this essay which is usually lacking in expositions of evolution from reverend pens. We have read this eloquent and able *brochure* with much interest, and with no small sympathy, for we are not slow in feeling with its talented author that all our ingenious explanations of processes do not touch the mystery of origins. But we cannot understand the invoking of a *deus ex machinâ* to account for the now impassable chasm between man and brute. Such a gratuitous assumption is probably made to render easier the passage to certain theological dogmas concerning man which find no support from the theory which Dr. Dallinger, as a Wesleyan divine, hesitates to apply to the evolution of man's spiritual nature.

Our Earth and its Story. By Dr. Robert Brown. (Cassell & Co.)—Dr. Brown ranks amongst our ablest and clearest expositors of the results of science, and he brings to the preparation of this book, which is the first volume of what is really an elaborate treatise on physical geography, the requisite knowledge and the skill of presentment which invest the record of the earth's changes with vivacity and charm. The work is well and lavishly illustrated.

The Saracens. By Arthur Gilman, M.A. (London: T. Fisher Unwin. 1887.) In reviewing a former volume of "The Story of the Nations" series, to which the present work belongs—we mean Professor Vambéry's "Hungary"—we spoke of its history as capable of being epitomised in the words "battle, murder, and sudden death." But the horrors of Hungarian history pale before those of that of the Saracens as told by Mr. Gilman, whose entire book is a sequent account of the most ghastly and ruthless slaughter, murder, treachery, violence, and deceit. As chapter after chapter teems with accounts of hideous carnage and butchery, our sympathy for the fiends in human form who perpetrated it evaporates, and we can only wonder that so relatively pure a religion as that of Islam should have bred, and been propagated by, such a race of ferocious and treacherous brutes. We read on and on, in a kind of vague hope that we may arrive at something like a peaceful settlement among those who owed allegiance to the Caliph, but in vain; and the exclamation of the villain in the melodrama of the old Victoria Theatre, "Wot, more bel-ood!" rises (in a more orthographical form) to our lips as we turn each successive page. But, *malgré* the revolting nature of his material, Mr. Gilman has given us one of the best popular accounts of the life and acts of Mahomet that has yet appeared, and has further shown how much more rapidly and effectually a new form of faith may be propagated with the sword than by any amount of missionary effort.

Electrical Distribution by Alternating Currents and Transformers. By Rankin Kennedy. (London: H. Alabaster, Gatehouse, & Co. 1887.)—Mr. Kennedy's small work is valuable, as containing information not to be found in any of our ordinary electrical text-books, and forms a useful addition to the library of the student of applied electricity. If the electric light is ever to compete with gas upon anything like a large scale, the cost of its production must be materially diminished, and the more the means of supply are simplified, the nearer we shall be to attaining that indispensable end. The most recent devices for obtaining alternating currents and the construction of transformers are described and fully illustrated in Mr. Kennedy's little book. There is a very good chapter, too, on measurements. The extent to which the volume is illustrated may be gathered from the intimation that no less than thirty-eight engravings appear in its sixty pages.

A Revised Currency System. By H. Bull. *The Instability of Gold as a Standard of Value.* Same Author. (London: Hamilton, Adams, & Co. 1887.)—All interested in the depreciated value of silver coin may read Mr. Bull's two essays with advantage. That a system should be perpetuated by which, to take a single illustration, soldiers and civilians serving in India are paid in rupees, such nominal rupee being only in reality worth some 1*s.* 5*d.*, seems nothing short of a scandal. Unfortunately, quackery is as rife in monetary theory as it is in medicine; and the present chances of the deposition of gold as the sole standard of value in the British Empire seem but remote indeed.

Laws and Definitions connected with Chemistry and Heat. By R. G. Durrant, M.A., F.C.S. (London: Rivingtons. 1887.)—This remarkably well-written little volume is not a text-book in the ordinary acceptation of the term, but rather a companion to the usual chemical text-books, heat being chiefly treated of in relation to chemical work. It will be found very handy by candidates preparing for examination. The descriptions of various tests and methods of analysis should be particularly useful to such candidates.

We have upon our table Books II. and IV. of *Moffatt's History Readers* (London: Moffatt & Paige), on "Early England" and "Modern England" respectively, in which a large quantity of historical information is conscientiously boiled down for the benefit of children attending elementary schools; also *Moffatt's German Course*, by G. H. Williams, M.A. (same publishers), sensible and practical; *Results of Rain and River Observations made in New South Wales, &c.*; *Notes upon Floods in the River Darling*; and *Notes upon Floods in Lake George*, in which Mr. H. C. Russell, the Government Astronomer for New South Wales, continues to add to the existing vast accumulated mass of statistics of the meteorological phenomena of that colony; *Bench Book for Test-Tube Work in Chemistry*, by H. T. Lilley, M.A. (London: Hamilton, Adams, & Co.), very handy for reference.

The Freshwater Fishes of Europe. By H. G. Seeley, F.R.S., F.G.S., &c. (London: Cassell & Co. 1886.)—Professor Seeley may fairly be congratulated on the value of his latest contribution to our knowledge of ichthyology, inasmuch as in the volume before us he describes the whole of the freshwater fishes of Europe for the first time,

systematically. His profusely and beautifully illustrated work is encyclopædic in its character, and should be upon the shelves of every student of the natural history and structure of the inhabitants of our rivers, lakes, and streams. And while the naturalist will find it an admirable work of reference, the angler will derive much information of the greatest value from its pages, and the *gourmet* gain many hints of modes of adding to his gastronomic pleasures. The variety of the fish which people fresh water will come almost as a revelation to the multitude who regard trout, jack, roach, dace, perch, and eels as constituting the major proportion, if not the entire bulk, of its denizens; for they will learn something of the history and structure of that strange survival from palæozoic times, the sturgeon; of the shad; of such rudimentary forms of creatures as the lampern, &c.; while those whose interest in fish may be said to centre in "little dinners at Greenwich" will discover that their favourite whitebait is nothing in the world but the fry of the herring. Doubtless Professor Seeley's work will become, as it deserves to become, *the* text-book of the subject to which it is devoted. The classification adopted is, in the main, the well-known and excellent one of Dr. Günther.

The Realistic Teaching of Geography. By WILLIAM JOLLY, F.R.S.E., F.G.S. (London: Blackie & Son.)—A more admirably common-sense little book than Mr. Jolly's has not recently appeared. It ought to be in the hands of every teacher of geography in the kingdom.

The Physiological Effects of Artificial Sleep. By Dr. MATHIAS ROTH. (London: Baillière, Tindall, & Cox. 1887.)—Dr. Roth has great faith in hypnotism, or artificially induced somnambulism, as a cure for various forms of neurotic disease, and in his small pamphlet gives a selection of cases to show how wonderfully efficacious this mode of treatment has proved. His *brochure* is worthy of study by all labouring under any form of nervous complaint, from the but too familiar neuralgia to those more obscure species of disorder in which the mind is more or less affected.

Humanism versus Theism is a series of letters by ROBERT LEWINS, M.D. (London: Freethought Publishing Company. 1887.)—There is no God but Lewins, and Naden is his prophet, may fairly be held to summarise the contents of this queer little tract. Mr. Montague Tigg in "Martin Chuzzlewit" "didn't believe that he didn't believe, hang him if he did," and Dr. Lewins seems drifting rapidly in the Tiggian direction.

Pneumatics. By CHARLES TOMLINSON, F.R.S., F.C.S. Fourth Edition, enlarged. (London: Crosby Lockwood & Co. 1887.)—Few writers in the present day possess the art of popular scientific exposition in a greater degree than Mr. Tomlinson; and in this fourth and enlarged edition of his well-known treatise on pneumatics, in "Weale's Series," he worthily sustains his reputation for rendering somewhat recondite physical questions easily intelligible to the reader ignorant of mathematics.

The Practical Engineer's Handbook. By WALTER HUTTON, C. and M.E. (London: Crosby Lockwood & Co. 1887.)—Arranged in a very convenient form for reference, Mr. Hutton's excellent cyclopædia of modern engineering workshop practice leaves nothing to be desired. Amply illustrated by no less than 371 woodcuts, and brought down in every department to the latest date, this is a volume which should be upon the shelves of everyone engaged in any of the numerous branches of modern mechanical engineering.

The Modern Treatment of Disease by the System of Massage. By THOS. S. DOWSE, M.D., F.R.C.P. (London: Griffith, Farran, Okeden, & Welsh. 1887.)—Among the latest of medical "fads" the treatment of disease by rubbing, pounding, and kneading the human body occupies a conspicuous place, and in the volume before us Dr. Dowse instructs us in the methods of "effleurage," "petrissage," "tapotement," and so forth. This used, we imagine, to be called sham-pooing, but possibly we have arrived at the real thing at last. If, though, we ever, for our sins, were compelled to undergo this peculiar process, we think that, like Sarah Battle, we should prefer "a quiet rubber."

Recent Advances in Electricity. Edited by HENRY GREER. (New York. 1887.)—In a series of articles by the editor of the *Electrician*, Professor Thomson, and Professor Edison, an account is given of all the more recent advances in applied electricity; and we have illustrated descriptions of the latest devices for electrical storage, of the method of telegraphing from a train in motion, of a navigable balloon or air-ship electrically propelled (with a cheerful engraving of the destruction of a town by shells or bombs dropped from the car thereof), of Mr. Edison's contrivance for the production of electricity direct from fuel, and so on. This pamphlet will be found useful by all engaged, either practically or theoretically, in the study of electrical science and art.

Bulletin of the United States Fish Commission. Vol. VI., for 1886. (Washington, 1887.)—In the 474 pages which make up this volume will be found an enormous mass of detail in connection with the breeding, rearing, catching, curing, and even cooking fish, derived from information supplied from all parts of the world. The interest and importance of this will become apparent when we reflect upon the incalculable wealth of food which fish might supply, and to how very limited an extent we avail ourselves of it. There is a certain fitness in our receipt of this valuable work at the time when an Anglo-American Commission on International Fishery is sitting in the United States.

The Microscope in Theory and Practice. Translated from the German of Professor CARL NAEGELI and Professor S. SCHWENDENER. (London: Swan Sonnenschein, Lowrey, & Co. 1887.)—This translation of a portion of Naegeli and Schwendener's well-known work (partly made by Mr. Crisp, though mainly by Mr. J. Mayall, jun.) may supplement our leading English text-books, but will assuredly never supersede them. At almost inordinate length, its authors enter into details a large proportion of which are to be found in such books as Dr. Heath's admirable "Geometrical Optics," to the exclusion of matter of much more real interest to—because less accessible by—the observer with the microscope proper. The small part of the volume devoted to technical microscopy is huddled up to make room for all this and cognate matter on polarisation. The portion on testing the optical power of the instrument would be useful to our opticians, but for the fact that they happen to be familiar with it already. The really valuable part of the book is that which is explanatory of microscopic vision, and which treats of the theory of microscopic observation generally. All those who conceive that the images of the markings on a diatom are produced in the same manner as that of a church spire in a landscape viewed with the naked eye, should study this portion of the work before us carefully. They may do so profitably and with advantage.

Sprains. By C. W. MANSELL MOULIN, M.A., M.D., F.R.C.S. (London: H. K. Lewis. 1887.)—It is a common saying that a simple fracture is not half so bad as a serious sprain, although undoubtedly in a large number of cases the gravity of the latter form of injury is too much underrated. As Dr. Moulin says in his preface

to the excellent and thoroughly practical little volume now before us, "It has been said, and not untruly, that in all probability half the crippled limbs and stiffened joints that are met with every day date their starting-point from the occurrence of some apparently trivial accident of this description." It is, then, to a practically exhaustive account of the nature and treatment of this grave form of lesion that our author devotes his work; and, although addressed primarily to the surgeon, it is written in such perspicuous and untechnical language that the layman may read it both with pleasure and profit. Dr. Moulin advocates more active modes of treatment (including galvanism, massage, pressure, &c.) than those ordinarily adopted; and no one can, we think, rise from the perusal of his book without being convinced that his ideas on this subject are justified alike by science and by common-sense.

Sound, Light, and Heat. By Mark R. Wright. (London: Longmans, Green, & Co. 1887.)—*Earth Knowledge.* By W. Jerome Harrison, F.G.S., and H. Newland Wakefield. (London: Blackie & Son.)—*Mineralogy.* By Frank Rutley, F.G.S. (London: T. Murby.)—*Euclid,* Book II. Arranged by A. E. Layng, M.A. (London: Blackie & Son. 1887.)—*New Explanatory Readers,* No. VI. *Geography* for Standards I. to VII. (London: Moffatt & Paige.)—*Problematic Arithmetic.* Edited by Rev. A. D. Capel, M.A. (London: Joseph Hughes.) —The mass of educational works whose titles we have grouped above are all more or less directed to the furtherance of that vicious system of examination whose ultimate result can only be that of cramming the rising generation with everything and teaching them nothing. The first three books on our list, however, are really too good for their professed purpose. Mr. Wright has boiled down Tyndall, Sedley Taylor, and Ganot in a fashion calculated really to impart a considerable amount of sound information. The "Earth Knowledge" of Messrs. Harrison and Wakefield is an honest and readable treatise on the bastard science of "physiography," and as absolutely superior to a volume bearing the latter title, recently issued from South Kensington itself, as it is possible to imagine. Mr. Rutley's "Mineralogy," too, contains a very large amount of information indeed compressed between its two covers. The rest of the works specified demand no special notice.

THE FACE OF THE SKY FOR FEBRUARY.

By F.R.A.S.

THE sunspot minimum having now passed, the observer may scrutinise the solar disc for spots and faculæ on every available opportunity, with a fair prospect of occasionally picking up both. The zodiacal light may be seen, somewhat to the south of west, after sunset, towards the end of the month. The night sky will be found depicted on map ii. of "The Stars in their Seasons." Minima of Algol ("The Stars in their Seasons," map xii.) will occur at 1h. 30m. A.M. on the 10th; at 10h. 19m. P.M. on the 12th; at 7h. 8m. P.M. on the 15th; and at other dates less convenient for the amateur for whom these notes are intended. Mercury is an evening star all through February, and attains his greatest elongation east of the sun (18° 5′) on the 16th. About this time he may be detected close to the horizon after sunset with the naked eye. He will be over a point to the south of west. Venus is a morning star, but is becoming more and more insignificant. Moreover, she is very badly placed for the observer. Neither Mars nor Jupiter has yet come into view during the working hours of the ordinary amateur's night. Saturn, however, is visible from sunset to sunrise, and is a glorious object for the observer with the telescope. He is in a blank part of Cancer to the west of the Præsepe ("The Stars in their Seasons," map ii.). Uranus is, for our present purpose, invisible. Neptune is in that void part of the sky some 6° south of the Pleiades ("The Stars in their Seasons," map i.). The moon enters her Last Quarter at 7h. 25·8m. P.M. on the 4th; is New at 11h. 52·5m. P.M. on the 11th; enters her First Quarter at 1h. 59·2m. A.M. on the 20th, and is Full 2·1 minutes before noon on the 27th. She will occult three stars during February, but one of them only at an hour when the phenomenon is fairly observable. This is the 6th magnitude star d^1 Cancri, which will disappear at the moon's dark limb on the night of the 24th at 9h. 30m., at an angle of 112° from the moon's vertex, reappearing at her bright limb at 10h. 28m. P.M., at a vertical angle of 226°. At noon to-day the moon is in Virgo ("The Seasons Pictured," plate xxv.), which constellation she quits at 4h. A.M. on the 4th for Libra ("The Seasons Pictured," plate xxvi.). Travelling across Libra, she, at 8h. 30m. P.M. on the 6th, arrives at the western edge of the narrow northern spike of Scorpio. When, by 5 o'clock the next morning, she has crossed this, it is to emerge in Ophiuchus. Her passage through Ophiuchus is completed by 8h. 30m. P.M. on the 7th, at which hour she passes into Sagittarius. Her journey over Sagittarius terminates at 4h. A.M. on the 10th, and she enters Capricornus ("The Seasons Pictured," plate xxi.). She remains just 48 hours in the constellation last named, and at 4h. A.M. on the 12th quits it for Aquarius. Here she continues until 6h. 30m. A.M. on the 14th, when she enters Pisces ("The Seasons Pictured," plate xxii.). Travelling through that part of Pisces where it is conterminous with Cetus, she enters the last-named constellation at 2h. A.M. on the 15th, to re-emerge in Pisces at 11h. A.M. on the 16th. Proceeding in her onward path, she once more enters Cetus at 10h. A.M. on the 17th; and when she finally quits it, at 5h. A.M. on the 18th, it is to come out into Aries ("The Seasons Pictured," plate xxiii.). She is in Aries until 5h. A.M. on the 19th, at which hour she enters Taurus. In the course of her journey across the constellation last named, she comes, at 3h. 30m. A.M. on the 22nd, to the western boundary of the northern prolongation of Orion. It takes her exactly 12 hours to cross this, and, at 3h. 30m. in the afternoon of the same day, she emerges in Gemini ("The Seasons Pictured," plate xxiv.). She is in Gemini until 10h. 30m. A.M. on the 24th, at which hour she passes into Cancer. At 11h. P.M. on the 25th she leaves Cancer for Leo, as she does Leo in turn for Virgo at 10h. A.M. on the 28th ("The Seasons Pictured," plate xxv.). She is in Virgo when these notes terminate.

Dark and Fair.—Statistics tell rather a curious story about the relative attractiveness of dark hair and fair hair. A modern author states that, according to statistics, for every two dark-haired women who are unmarried there are three fair-haired ones. This in itself has no particular value, being, in fact, one of the customary stupidities of statistics. It tells nothing as to the relative number of dark and fair women who may marry, simply because it takes no account of the relative number of dark and fair women who exist in the community. If there were three fair-haired women for every two dark-haired women, the observed proportion between the fair and dark unmarried women would indicate no preference for one or the other hue. But as it is probable that there are more dark-haired women than fair-haired women, and even a great relative excess in the number of the former, the relatively small number of dark-haired women among the unmarried seems to indicate a well-marked preference on the part of the harder sex for the darker sisterhood. Albeit the evidence requires to be carefully analysed before this can be regarded as a demonstrated fact.

Our Chess Column.

By "Mephisto."

A pretty game played at the Frankfurt Tournament.

French Defence.

White. Prof. Berger.	Black. Dr. Noa.	White. Prof. Berger.	Black. Dr. Noa.
1. P to K4	P to K3	14. P to B5 (*f*)	K to R2
2. P to Q4	P to Q4	15. QR to K sq	R to Kt sq (*g*)
3. QKt to B3	B to Kt5 (*a*)	16. QKt to K2	QKt to Q2
4. P × P	P × P	17. Kt to B4	R to Kt4 (*h*)
5. B to Q3	KKt to B3	18. R to K2	P to Kt3
6. Kt to K2	Castles	19. KR to K sq	B to Kt2
7. Castles	R to K sq	20. P to B3	QR to KKt sq
8. B to KKt5	P to B3	21. Kt to K6 (*i*)	K to R sq
9. Kt to Kt3	P to KR3 (*b*)	22. Kt × R	R × Kt
10. B to KB4	B to Q3	23. Q to K3	Q to B8
11. Q to Q2 (*c*)	P to KKt4 (*d*)	24. Q to B1	Q to Kt7 (*j*)
12. B × B	Q × B	25. R to KS(ch)(*k*)	K to R2
13. P to B4 (*e*)	P to Kt5	26. R to Q8	Resigns (*l*)

NOTES.

(*a*) Not favonrable for the defence: K Kt to B3 is better.

(*b*) Black is delaying the development of his forces too long, and this move weakens his King's side.

(*c*) White has his pieces in good play, and although he does not threaten B × RP immediately, that move may soon become possible.

(*d*) Weakening his position still more: he should have played B × B.

(*e*) White follows up his advantage in development in the best possible way, giving Black no breathing time.

(*f*) If Black had played P × P, then R · P and QR to KB sq would have given White an advantage.

(*g*) B to Q2 was preferable.

(*h*) To prevent Kt to R5, but it was not good, although it would be difficult to suggest a better move. P to B4 might have been tried here.

(*i*) A very fine move, for if Black replies with P · Kt then 22. P × P (disc ch), K to R sq. 23. P × Kt to be followed by R to K7 or K6 winning (*see diagram*).

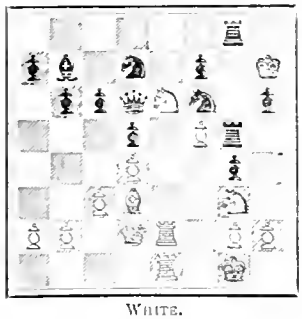
(*j*) The Queen is badly placed on Kt7.

(*k*) Black cannot take the Rook, for after Kt · R. 26. R · Kt(ch), K to R2. 27. P to B6 (ch) wins.

(*l*) White threatens to take this Knight as the Kt on B3 dare not move, and if Kt to B sq then Q to Kt8 or R to K7 or K8 wins.

POSITION AFTER WHITE'S 21ST MOVE.

BLACK.



WHITE.

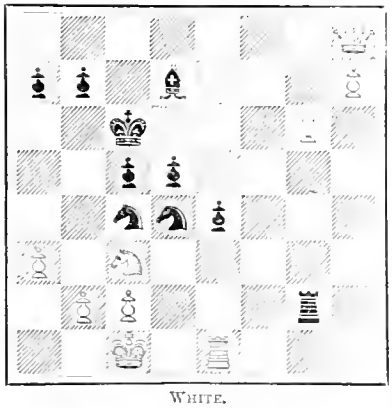
This game shows plainly the great disadvantage which arises by proper play through losing time in the opening.

A CHAPTER OF ACCIDENTS.

Nobody is infallible, and the player who makes the least number of mistakes is the strongest player. In Tournament play every mistake counts, whereas in match-play it does not to that extent, for if a player loses a game in a match, he can always recover himself if he is the stronger player. The following incredible series of mistakes occurred in the game, Gunsberg *v.* Burn, played in the Tournament of the B.C.A.

BURN.

BLACK.



WHITE.

GUNSBERG.

It was White's move, and he played—

Q to B6 (ch)

Q × Kt, P × Q, Kt to R2 would have won easily.

B to K3

Q × Kt

Still right, but White might have defended simply by Kt to Q sq, winning again easily.

P · Kt

Kt to R2

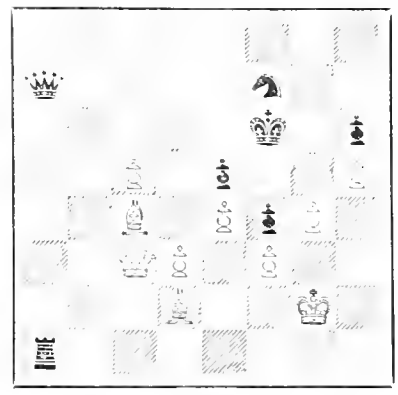
Fatal. If, instead of this, White plays simply P to R8 (Q), he still wins.

White has made three successive weak moves, and under certain awkward circumstances such play might give rise to grave conjectures. The result of the loss of this game was that Gunsberg was not absolute first, but tied with Burn.

Experience has proved that luck sometimes equalises itself. Having had bad luck in the above game, Gunsberg had a piece of good luck in his game with Bird, which, although it did not fully counterbalance the loss of the previous game, yet it enabled him to remain in front. The position was as follows:—

GUNSBERG.

BLACK.



WHITE.

BIRD.

Black had been fighting an up-hill game for a long time, and had no chance by correct play. He played

Kt to Q3,

which gave White the opportunity of mating in two moves by Q · P (ch), K · Q, and B to Kt2 mate. White, however, did not see this pretty but by no means so very obvious move, but played

B × P,

an inferior move, to which Black replied with

Kt · B

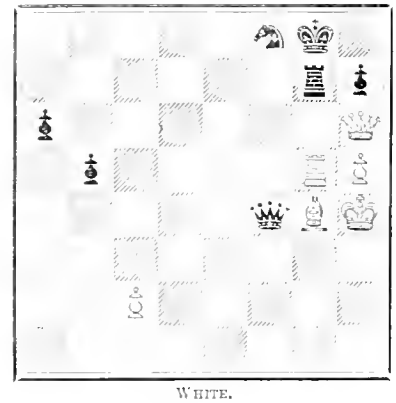
P · Kt Q to R7 (ch) and wins.

Even on his last move White would have done much better by playing Q × Kt, when the win would not by any means be assured by Black exchanging Queens, as White would remain with too many Pawns.

Yet another mistake occurred in the following game played in the tie. Black might have won here by Q to B7 (ch); K to R3;

GUNSBERG.

BLACK.



WHITE.

BURN.

Q to K6 (ch); K to R4; Kt to Kt3 (ch), and Black wins; for if P × Kt Black wins the Queen by Q to K8 (ch) K to R3, Q to R8 (ch); but if R · Kt, then Q to K8 (ch) – K to R3, R · R wins. Instead of this, the game proceeded in the following manner:—

	R · R
Q · R (ch)	Q × Q
K × Q	P to R4
K to B6 !	P to R5
K to K7 !	K to Kt2
B to B3	P to R6
B to Q5	P to Kt5
K to Q6	K to R3
K to B5	

And the game was drawn after a few moves.

Our Whist Column.

By "Five of Clubs."

Mathews on Whist.

Ruffing and Forcing.

(*Continued from p.* 47.)

WHEN your partner shows a weak game, force him, whether or not you would otherwise be right in so doing. It is seldom right to refuse a ruff when your partner, if a good player, visibly intends you should do it; if he is a bad player your own hand should direct you.

Should your partner refuse to trump a certain winning card, try to get the lead as soon as you can, and play out trumps immediately.

When your partner plays a thirteenth card, and most of the trumps are unplayed, he generally means you should put a high trump to strengthen his own hand. [Either leave the card alone, to draw a trump from fourth hand, or trump with your best.]

Play of Trumps.

Take every opportunity (when sufficiently strong) to show your partner that you can command the trumps. In that case he will keep his own strong suit entire; whereas if the strength of trumps were with the adversaries, his play would be to keep guard on their suits, and to throw away from his own. [We have here, again, the true principle of the discard as determined by the position of trump strength.] If you have, as fourth player, to win a small trump, and you hold a sequence of three or more, win with the highest and play the lowest afterwards [thus informing your partner of your strength] Keep the trump card as long as you can when your partner leads trumps [or when you are strong in trumps yourself]; the contrary if an adversary leads them. Thus, in the former case, if the eight is turned up and you have the nine, throw the nine [when one or other of the two is to be played]: in the latter case, play the card turned up, even though you have the seven and six.

It is equally advantageous to lead up to as through an ace; less advantageous to lead up to a king turned up; and disadvantageous to lead up to the queen.

It frequently happens when you have led from six trumps, that after your second lead you remain with three or four cards, the best being in an adversary's hand. In such situations play a small trump. This has two advantages—first, it prevents the stopping of your partner's suit; and secondly, it gives you the tenace in whatever suit the adversary may lead. This, *mutatis mutandis*, will show that it is bad play to lead the best trump, leaving others in the hands of your adversaries. It may do good to keep it in hand, as you may be able to stop an adversary's suit with it; and it can answer no good purpose whatever to play it out. [The last statement is, however, too general, and is indeed flatly contradicted by Mathews's own statement in another place, where he says] If, however, they both have trumps and your partner none, it is right to take out two for one [though this in turn is too general, for often you play the enemy's game in so doing. Nothing but practice and experience can show what is best in particular cases. Still the general rule remains sound.] If you remain with the best trump, and one of your adversaries has three or more, do not lead your trump, as it may stop the suit of your other adversary.

Moderate players have generally a decided aversion to part with the best trump, though single, thinking that as they cannot lose it, and it can make but one trick, it is immaterial when it does so [and misled also in many cases by the hope of drawing two trumps from the enemy with it, if they can *lead* it instead of ruffing with it.] This is a dangerous fault [though in cases, of course, it may be judicious, never essential; usually] When your adversary plays out his strong suit, ruff it immediately rather than give his partner an opportunity to throw off his losing cards. Do not, however, go into the contrary extreme, or trump with the best trump, with small ones in your hand, for fear of being over-trumped. This is a nice part of the game, and can only be understood by practice and attentive reasoning.

The last trump is often of most material advantage to a good player. Thus, A has the thirteenth trump, with the ace and four small ones of a suit not yet played, of which the adversary leads the king and queen; by passing them both, A probably makes three tricks in the suit, but had he won the king he could not possibly make more than one. He might safely win the queen, however, and take out a third round, trusting to his thirteenth trump to bring in the remaining two, which would then probably be long cards in the suit. Without the thirteenth or a sure trump re-entering card A could not probably in any play make more than one trick in the suit.

When all the trumps are out, if you have the commanding card of your adversary's suit, you may play your own suit as if you held the thirteenth trump.

If the trumps remain divided between you and your partner, and you have no winning card yourself, it is good play to lead a small trump, to put the lead in his hand that he may play off any leading cards he may have, and so give you an opportunity to throw away leading cards. For instance, A remains with two or more trumps and two losing cards; B, his partner, with a better trump and two winning cards. It is evident that if A plays a losing card he will make merely his own trumps; but if he plays an inferior trump, and so puts the lead into his partner's hands, B will play his winning cards, while A throws away his losing ones. [The question is only of one trick if A only holds two trumps and two losing cards; but if A holds three trumps and two losing cards, his partner also holding two losing cards in the same suit or suits, A loses two tricks if he leads a losing card.]

Science in Whist.

Mr. Ram writes to us again as follows:—

"If a whister, who claims to play a game which may be legitimately styled 'scientific,' were after, say, the fourth round of each game, to put in black and white a list of the cards which he opined were in each of the other three hands, and were at the same time to make a forecast in detail of what the play of each of the four players for the remainder of that game would in his opinion be; and at the end of the said game were to compare the document with a corresponding statement which had been made by a fifth person who had actually seen the cards, how long would he continue to style his play 'scientific'? 'Five of Clubs' allows that 'bad' play may be successful against 'good' play for days together! In what proportion of games would a bad chess-player beat a good player? Is not the play in whist necessarily always a mere muddling along?"

Whist is no "mere muddling along," as Mr. Ram would find if he knew anything of the game. Since he evidently does *not*, it would be idle to attempt to convince him. As to his question, I simply reply that the experiment he suggests, if tried at a table where all the players knew the game, would quickly shew even those who know little of whist the value of scientific play. Where two partners play scientifically against two who know little of whist, the influence of science is increased, though the power of reading all the hands is diminished. Albeit, it very seldom happens that among even the best players the first four rounds show the position of all the chief cards. Usually nearly all is learned by about the middle of the hand, after which nearly everything depends on strategy. But sometimes the position of several important cards remains hidden nearly to the last. Even then, however, the scientific player can tell the relative chances that such and such cards lie in such and such hands; and if he then plays according to his estimate of the chances, he is playing scientifically, and will come out right in the majority of instances.

When whist *is* mere muddling along, as, doubtless, all the whist Mr. Ram has ever played *has* been, the game is wearisome in the extreme. I do not care to sit down myself to play whist when even one of the four players is ignorant of the language and science of the game. With two such players as opponents, and a good partner I should be sure of winning heavily in the long run But it is infinitely pleasanter to be so matched by good play as not to win heavily or at all, in a series of games sufficiently long to eliminate the effects of chance.

N.B.—Mr. Ram can never tell the difference between scientific whist and bumblepuppy till he has played as one of a whist party, all four of whom are sound players.

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GOD'S UNIVERSE.

IN old times men looked round upon the earth, seeing there the whole world, the kingdom over which the gods ruled, while in the heavens above they recognised the temple in which their gods abode and were enshrined. There is something strangely impressive in the thought of what earth and heaven must have been to men in those days. We talk of myths doubtingly and coldly, because we cannot readily place ourselves in the position of those who were moved to make myths. We cannot readily picture to our minds what they not only saw, but felt; what—if we consider their position aright—we see they could not help feeling. The grave business man is as unable to recall the fancies of his two-year-old childhood, and so interpret the feelings of his two-year-old child, as the more advanced races of man to-day to recall the feelings with which the child-man contemplated the mysteries of earth and sun and moon, and the yet more marvellous mystery of the star-strewn heavens. Our school children can at least verbally describe the globe of the earth; they can name the great distance separating us from the sun, and speak of his size and might and power; they can tell how Copernicus and Kepler and Newton explained the strangely seeming movements of the planets. But grown men in old times could not interpret aught they saw. To them the earth's renewal of life year after year was a standing mystery; the sun, as day by day he renewed his victory over the powers of darkness, yet day after day sank to seeming death in the blood-stained western fields, was as a living, acting, and enduring being, a veritable giant power, rejoicing as a giant to run his course. The moon seemed of set purpose to bear sway over the skies of night, as month after month she returned to full midnight glory, and though she "nightly changed in her circling orb," waxing and waning in power, even in this her individuality and self-power seemed attested. She seemed to measure time for man, as if specially considering his wants. Even more strikingly did the planets, as they pursued

> Their wandering course, now high, now low, then hid,
> Progressive, retrograde, and standing still,

seem to exercise powerful sway over the destinies of men. It was not merely, as Wordsworth sang, that these "radiant Mercuries"

> Seemed to move,
> Carrying through ether, in perpetual round,
> Decrees and resolutions of the gods,

but that they seemed to be themselves veritable gods. Men watched the movements of those divine beings even as children in Catholic churches watch the entrances and the exits of mitred bishops, robed priests, and surpliced acolytes, recognising in each a solemn religious meaning, though not knowing what their movements and ministrations may precisely signify. They had no need in those days, so far as worship was concerned, of "temples made with hands," for the arched dome of heaven, alike by day and by night, was their temple, the sun and moon, the stars and planets, were their gods. But that they might note with due precision the positions and movements of these ruling powers, they required earthly structures, and those structures, thus raised to watch the movements of their gods, became sacred: their pyramids and towers were like lady-chapels within a vast cathedral, their gnomons and obelisks were as altars or other essential adjuncts of their Sabaistic temples.

Turn without passing through all the intermediate stages of men's progress, at once from the simple adoration of those older times, when men prostrated themselves bodily before the orbs of heaven, to the teachings of modern science, and it might seem that men had become on the one hand altogether wiser, on the other altogether less reverent. Think what the earth is to us now in its lessons of a vast antiquity of ever-changing aspect, of ever-varying forms of life! Consider the infinite depth and solemnity of the tones in which the heavenly orbs speak to man to-day! We are then disposed to smile at the simple, the almost touching ignorance of mankind, during the childhood of their race. Yet, even as the grown man looks back with something of regret upon the fond hopes of youth, and even on the foolish fancies of boyhood and the illusions of infancy, so might the profoundest student of to-day be led to envy former ages their simpler faith, did he not recognise that the universe as we see it to-day, rightly understood, presents a grander and more enduring temple for men, a more wonderful power for their worship than the men of old times could even have imagined.

Consider the steps by which men passed from their former contented ignorance to their present growing, but ever unsatisfied, thirst for knowledge—noting at every step how the unknown and unexplained seemed ever to be the place of Deity, but that while the unknown was ever passing into the domain of the known and the unexplained into the domain of the understood, men's recognition of the immensity of the unknowable, the infinity of the inexplicable, has been ever growing clearer and more defined—so that whereas once men saw a temple in the skies and deities in the orbs of heaven, the universe itself is now recognised as the temple of the godhead, the power working in and through all things as Almighty Omnipresent—aye, and *Ever-manifest*—Deity.

First came the recognition that our earth is a globe, and the measurement of that globe's size. The nations of old times had doubtless come to recognise the earth as occupying a large space, for they knew that long distances separated Babylon from Egypt, and either from India, and so forth. None of the earlier nations can have doubted that the earth's surface must be measured by millions of square miles, or the equivalent of such spaces in their modes of measurement. Still, the surface they had imagined as belonging to the earth was almost as nothing compared with the 200 millions of square miles which they recognised as forming the surface of the entire globe, even when they had measured but small arcs of it, and surveyed but a minute portion even of the regions known to them. Then the recognition of the fact that this globe-shaped home of the human race is suspended, as it were, in mid space, even if it be considered (as by them it was considered) to be the fixed centre of the universe, must have had an impressive effect on the minds of thinking men.

Still all this was as nothing compared with the significance of the demonstration by Copernicus that the earth and the planets form one family, the sun being the centre about which they all travel. Because, so soon as this had been

accomplished, it became possible to form a clear idea of the relative distances and even some idea of the actual distances of the other planets, and thus to form adequate ideas of the relative importance of those orbs as compared among themselves, and even as compared with the earth. The addition to the universe of five other worlds, probably at least as large (on the average) as the earth, was assuredly a most striking achievement. No wonder if the more narrow-minded among religionists, unable to reconcile such a discovery with the limited ideas they had formed of the might and wisdom of the Deity, shuddered with horror at the daring of the Copernicans in imagining (nay, in even venturing to prove), that there may be other worlds than ours.

Even this, however, was in turn but nothing when compared with the discovery of the real meaning of the stars, following almost immediately on the recognition of the real nature of the planets. Tycho Brahe, who was moved with something like indignation against the doctrines of Copernicus, pointed out at once that if they were true every star must be an orb of enormous size and splendour, perhaps comparable even with the sun, which he regarded as preposterous. For, said he, our earth could not circuit in this immense orbit which the fond Copernicans assign to her, without causing the constellations to change entirely in aspect in the course of each year. In autumn or winter, for instance, we look at the constellation Orion from a position many millions of miles away from that which we occupy when we look at that constellation in spring. Hence the star groupings would present an entirely altered appearance, unless we are to imagine that such a distance as 100,000,000 of miles (the real distance is 186,000,000 of miles, but Tycho Brahe did not know that) counts for nothing as compared with the distances of the stars. But if so, if they really lie at distances which must be measured by thousands of millions of miles, we need only remember that our sun removed to such distances would look no larger than a star, to see that we must regard the stars, manifestly self-luminous as they are, as veritable suns, if this pernicious Copernican theory is admitted.

When Kepler and Newton had established the Copernican theory on altogether irrefragable evidence, and when the telescope enabled men to measure the planets, still grander ideas about the universe began to force their way into men's minds. It was seen that Jupiter and Saturn are very much larger than the earth, and are the centres of systems of subordinate worlds. With increasing accuracy in the estimates of the sun's distance, it was seen that all the planets are farther off, and therefore larger than had been supposed. It became, in fine, certain that the earth is not the chief member of the family of worlds attending upon the sun.

But this was nothing compared with the amazing significance of the self-same telescopic teachings in regard to the stars. Not only did every increase in the estimate of the sun's distance increase in corresponding degree men's estimate of the stars' distances, but every increase in the power of estimating position made clearer and clearer the apparent fixity of the stars, and therefore threw them, as it were, farther and farther back into the abysses of space. It had been wonderful enough that the eye could detect no relative displacements among the stars as the earth circled in her wide orbit around the sun. But it presently became clear that, even with the immense increase in the power of determining positions which the telescope gave to astronomers, no sign of change could be detected during the year in the position of any star. Bradley attacked the problem, but though he worked so well that he was able to detect the annual change due to the aberration of light and the nutation (or nodding motion) of the earth's axis, he discovered no annual displacement. The best astronomers in Great Britain and on the Continent attempted the task and failed. At length astronomers gave up hope, beginning to regard the stars as, all and severally, too far removed to afford appreciable evidence of displacement as the earth revolved in her wide orbit around the sun.

But just when success was despaired of, a double success was secured. Henderson, at the Cape of Good Hope, recognised the measurable annual displacement of the bright star Alpha Centauri; while Bessel, at Konigsberg, recognised a smaller yet measurable displacement of the faint star (barely visible to the naked eye) numbered 61 in the constellation of the Swan. (Bessel had chosen this faint star for observation because it is moving much more rapidly on the star sphere than its fellows, as if it were relatively near the earth, so that its motion, though not really greater than that of other stars, appeared greater through the effects of proximity.) But when at last the problem had been mastered, when for the first time the actual distances separating us from the stars, and the stars from each other, came to be recognised, how tremendous those distances were found to be! The nearest of all the stars in the heavens lies twenty millions of millions of miles from us, in such sort that light speeding with a velocity of 187,000 miles in a second takes more than three years in coming to us from that star. Our sun removed to the same distance would appear but as a star—nay, he would be a very much smaller star, in appearance, than that nearest of all our neighbouring suns.

But in the meantime, while one set of astronomical researches was showing astronomers the immensity of stellar distances and the sunlike character of every star, another set of researches had shown and was showing the vastness of the numbers of the suns within our galaxy. The thousands of suns visible to the naked eye had increased to hundreds of thousands in the days even of Galileo. Another century had shown astronomers that the stars within telescopic range must be counted by millions. Sir William Herschel's gauges of the star depths had shown that our estimate of the numbers of the stars must run into tens and even hundreds of millions. And to-day, it is well known that if the most powerful of the telescopes made by man could be used in surveying every portion of the heavens, the total number of stars which would be brought into view would far exceed one thousand millions. The increase with each increase of telescopic power has, moreover, taught the lesson that we can in no sense limit our estimate of the number of stars by the number which even our most powerful telescopes would show. If we could double the space-penetrating power of our telescopes, we should probably much more than double, we should increase manifold, the number of stars—that is, of suns—which would be brought within our ken. Not thousands of millions, but probably millions of millions of suns exist within the limits of the sidereal system. Rather—I ought to say—they exist within the limits of our sidereal system, for doubtless this system is no more to be regarded as single within the universe than our solar system is unique within the star depths. Every star tells us of a sun, and probably of a solar system, in such sort that we must recognise thousands of millions of solar systems in the galaxy. May we not fairly assume, then, that in like manner our sidereal system is repeated millions of millions of times within some system of a higher order. That system may be in turn repeated many millions of times within a system of a higher order. And so on, to higher and higher orders, absolutely without end.

Recognising this as the teaching of the astronomy of to-

day, and noting how great to us appears the earth itself, though she is but the first step in an evergrowing series, each successive term of which enormously surpasses the preceding, we cannot but perceive that it is infinity, not mere vastness with which we have to deal: "End is there none to the universe of God; lo, also, there is no beginning."

SHAKESPEARE SELF-DRAWN.

By Benvolio.

I.—"TITUS ANDRONICUS."

EAST attractive of all the Shakespearean plays, in certain passages absolutely repulsive, "Titus Andronicus" is yet in many respects most interesting to the Shakespearean student. When as yet little had been done towards classifying Shakespeare's plays in the probable order of their production, it was natural that this play should simply be rejected as not Shakespeare's work at all, save, perhaps, that a passage here or there might be regarded as thrown in by his master hand. It was obvious that the author of "Macbeth," "Othello," and "King Lear," whose method of treating tragic horrors is so powerful, cannot have been also the author of the crude horrors, the repulsive yet weak and almost ludicrous sensationalism of "Titus Andronicus." And that remains obvious still. But Shakespeare in 1587-89 was not Shakespeare the author of "Hamlet," "Julius Cæsar," "Macbeth," and "Coriolanus." He was a young man, country bred, imperfectly educated, associated with dramatists and actors of greater knowledge and experience, one in whom the audacity of youthful genius was tempered indeed, but not by his own judgment but by deference to the judgment of men really his inferiors, whom he then naturally regarded as his superiors. Moreover, it must be remembered, that even if Shakespeare himself, as a very young man (from twenty-three to twenty-five) had been able, against the judgment of experienced actors, to decide that plays like Kyd's "Spanish Tragedy," and the other bloody tragedies which had been in vogue for years before he came to London, were coarse and repulsive, he would still have been disposed to believe that such tragedies, nevertheless, must be purveyed for audiences whose tastes probably were as coarse as those of the modern audiences at the Victoria Theatre and (till lately) of the Surrey Theatre. It is certain that Shakespeare, even far later in his career as a dramatist, wrote for the groundlings as well as for the more cultured among his audiences; it is certain also, that, until late in that career, he regarded play-writing as belonging to an inferior order of literary work. We can hardly suppose that Shakespeare failed to recognise later the value of his plays as poetry; but he had probably written a dozen plays before the time when he would have set any of them on the same level with his "Lucrece," or even with his "Venus and Adonis." Thus, in considering Shakespeare's part in the production of "Titus Andronicus," the earliest of all his plays, we are free to admit much which we should at once reject if the play belonged to a later date: while, in the case of offensive, even repulsive passages, which we may thus either attribute to Shakespeare's pen or regard as having passed his scrutiny uncondemned, we may recognise rather the modesty of his youthful mind, accepting what his elders approved, and even writing in the style which seemed to them good, than absolutely coarse tastes even at the time when he was little more than a half-educated country lad.

Shakespeare's connection with "Titus Andronicus" is much more clearly made out than his authorship of many of the plays which bear his name. The play is one of six tragedies mentioned by Meres (*Palladis Tamia*, Wit's Treasury) in 1598, as proving Shakespeare's excellence; and it must be remembered that the association of Shakespeare's name with a play in the days when as yet his fame was not established on the firm footing which it afterwards had, is much more decisive of the question of authorship than similar evidence would be in after years when Shakespeare was the acknowledged leader among the dramatists of his age. We can understand how Fletcher's name came to be dropped from the title-leaf of "Henry VIII.," of which Fletcher certainly wrote more than half; but had not Shakespeare written much more than the half of "Titus Andronicus," his name would certainly not have been associated with it when it appeared (perhaps 1589) or for many years after.

Even if we had to accept the whole play as Shakespeare's (which, fortunately, is forbidden by external and internal evidence alike) we should find scarcely a greater contrast between "Titus Andronicus" and "King Lear" (the later tragedy to which it is nearest akin), than there is between "Love's Labour's Lost," the earliest comedy, and "Twelfth Night," Shakespeare's finished work. As much of the falsely heroic as there is in "Titus Andronicus," so much at least is there of false humour in "Love's Labour's Lost."

It has been remarked by a laborious Shakespearean student respecting "Titus Andronicus," that it would be unsafe to attempt to point out certain passages as Shakespeare's, because we do not know the distinguishing features of his style when he first began to write for the stage. To my mind this remark suggests small critical acumen. It would be unsafe to point out certain passages as not Shakespeare's, and for the reason indicated, that we do not know what characteristics distinguished the Shakespeare of the time when "Titus Andronicus" appeared. But this need by no means prevent us from recognising passages as undoubtedly Shakespearean which present characteristics such as his work, and his alone, has displayed.

Viewing "Titus Andronicus" thus, the student who has entered into Shakespeare's mind and character, and has learned to know the ring of his music, will, I believe, recognise much more of "Titus Andronicus" as certainly Shakespeare's than critics of the Furnivall school imagine; while he will be disposed to reject as not Shakespearean much less than he would were the play to be dealt with as belonging to the prime of Shakespeare's dramatic career.

Nearly the whole of the first scene is Shakespearean in tone. In particular the description by Marcus Andronicus of his brother's services to Rome, all but the first few lines is manifestly from the same hand, as yet, however, unpractised, which later wrote Coriolanus's speech, beginning "Hail, lords! I am returned your soldier." Compare with this also the speech of Titus himself in scene ii.:—

> Hail Rome, victorious in thy mourning weeds!
> Lo, as the bark, that hath discharged her fraught,
> Returns with precious lading to the bay
> From whence at first she weighed her anchorage,
> Cometh Andronicus, bound with laurel boughs,
> To resalute his country with his tears.

If in this speech and much which follows in scene ii. we recognise the "'prentis han'," that hand is still manifestly the hand of Shakespeare. Even in the schoolboy Latin introduced here and elsewhere throughout this crudely concocted tragedy, we may find something Shakespearean, ay, and something throwing light on Shakespeare's character in

boyhood and youth. We have a touch also of Shakespeare's own self in the lines :—

> Wilt thou draw near the nature of the gods?
> Draw near them, then, in being merciful;
> Sweet mercy is nobility's true badge.

The touch is all the truer that it is dramatically inappropriate. When Portia speaks of mercy as "an attribute to God himself," as "mightiest in the mighty," and as befitting "the throned monarch better than his crown," we feel that it is Portia who speaks; and, though we need not therefore regard the passage as wholly without significance respecting Shakespeare's own nature, we have yet in the dramatic fitness of the sentiments a sufficient explanation independently of Shakespeare's personal character. But when Tamora speaks so nobly of mercy, ignoble of nature, and cruel as she was, our sense of the dramatic impropriety of the sentiment in her mouth enables us the more confidently to regard that sentiment as coming from Shakespeare's own heart. Tamora might have begged abjectly for mercy; but she could no more have pleaded with such earnestness of reasoning than Portia, most intellectually gifted of all Shakespeare's women, could have pleaded with Shylock to be merciful only out of pity.

Later in scene ii. we come in all probability on the material of the original play, which Shakespeare can only have left in despite of his better judgment The murder of Mutius by Titus would be repulsive were not the passage made utterly ridiculous by the coolness with which Titus, Lucius, Martius, and the rest treat the whole affair. If Shakespeare kept this play, as it remained after his re-writing and revision, and later looked it over, how his developed dramatic taste must have been at once offended and amused by the remark of Lucius as he enters on hearing his brother's dying cry :—

> My lord, you are unjust; and, more than so,
> In wrongful quarrel you have slain your son! *

In the beginning of act 2 four lines occur which no one but Shakespeare could have written—at least, as lines in a play dating so far back as 1589. I refer to the description of sunrise :—

> As when the golden sun salutes the morn
> And having gilt the ocean with his beams
> Gallops the zodiac in his glistering coach,
> And overlooks the highest-peering hills.

I do not remember, by the way, the use of the word "peer" in the sense here given to it by any of Shakespeare's dramatic contemporaries. Shakespeare himself uses it in a kindred sense in "Henry V.," where Henry, speaking of the French "horsemen on yon hill," says :—

> . . . yet a many of your horsemen peer.

Further on in act 2, in the passage which introduces the repulsive lusts of Demetrius and Chiron, we find lines which are remarkable as being the only passage repeated (in effect) thrice over in Shakespeare's works. She is a woman, says Demetrius of Lavinia :—

> She is a woman, therefore may be woo'd;
> She is a woman, therefore may be won;
> She is Lavinia, therefore must be lov'd.

In the first part of "Henry VI.," in a scene unmistakably from Shakespeare's hand, Suffolk says of Margaret :—

> She's beautiful, and therefore to be woo'd;
> She is a woman, therefore to be won.

And if any doubt could remain that these are Shakespeare's words, it is removed when we note that his 41st sonnet has the lines :—

> Beauteous thou art, therefore to be assail'd;
> Gentle thou art, and therefore to be won.

The thought here conveyed, and the form in which the thought is presented, must have had a singular charm for Shakespeare, that he (who so seldom repeats himself) thus frequently repeats this idea in almost the same words.

I know of no passage more truly Shakespearean in "Titus Andronicus" than the forest scene, as described (inappropriately enough) by Tamora, that "unhallowed dam," addressing the ravenous tiger and accursèd devil," Aaron the Moor :—

> My lovely Aaron, wherefore look'st thou sad,
> When everything doth make a gleeful boast?
> The birds chant melody on every bush;
> The snake lies rolled * in the cheerful sun;
> The green leaves quiver with the cooling wind,
> And make a checker'd shadow on the ground;
> Under their sweet shade, Aaron, let us sit,
> And whilst the babbling echo mocks the hounds,
> Replying shrilly to the well-tun'd horns,
> As if a double hunt were heard at once,
> Let us sit down and mark their yelping noise,
> And after conflict, such as was suppos'd
> The wandering prince and Dido once enjoy'd,
> When with a happy storm they were surpris'd,
> And curtain'd with a counsel-keeping cave,
> We may, each wreathèd in the other's arms,
> Our pastimes done, possess a golden slumber;
> While hounds, and horns, and sweet melodious birds,
> Be unto us, as is a nurse's song
> Of lullaby to bring her babe asleep.

One might imagine this addressed by Venus to Adonis; one might imagine it part of a poem written by Shakespeare on the theme of his "Venus and Adonis," but in another strain; one may even imagine in it a picture of fair but forward Anne Hathaway pleading with her youthful love; but while one can see no fitness in words such as these placed in the mouth of the fiendish Tamora, one cannot imagine that any penned them but Shakespeare. The style is his, the thoughts are his, the words are his; but, beyond and above all, the music is his, and none other's.

Repulsive as is the rest of this scene, no one, I think, who compares the appeal of Lucretia to Tarquin in Shakespeare's "Lucrece" with the appeal of Lavinia to Tamora and her sons, can doubt that the former is not more certainly Shakespeare's work than the latter. The scene is one on which no reader cares to dwell, even to note what is beautiful amid so much that is horrible, Yet what could be more pathetic than Lavinia's appeal?—

> Some say that ravens foster forlorn children,
> The whilst their own birds famish in their nests:
> O, be to me, though thy hard heart say no,
> Nothing so kind, but something pitiful.

Scattered throughout "Titus Andronicus" we find many expressions and tones characteristically Shakespearean. Compare, for instance—

> *Martius.* To prove thou hast a true-divining heart,

with

> *Juliet.* Oh God! I have an ill-divining soul;

and

> *Demetrius.* I would we had a thousand Roman dames
> At such a bay,

with the lines—

> Ah! that I had my lady at this bay,†
> To kiss and clip me till I run away,

* Yet even this, regarded as due to mere carelessness, is matched by Imogen's coolness when Guiderius, whom she had loved as a brother (not knowing that he actually was her brother) has been condemned to death. "Thou art dead," says Cymbeline to Guiderius; and Imogen is only moved to remark that she has mistaken the man whom Guiderius had killed for her husband.—*Cymbeline*, last scene.

* Probably a misprint for "coiled," a word which might be so written as to be mistaken for "rolled."

† The word "bay" is here used in the hunter's sense, as again in Titus's speech at the beginning of scene 2, act ii., "Uncouple

(in the fourth of the poems—some undoubtedly not by Shakespeare, but this one certainly from his pen—included under the strange heading "The Passionate Pilgrim"); and again—

Aaron. Here's a young lad, fram'd of another leer,

with Celia's, "he hath a Rosalind of a better leer than you."

"Titus Andronicus" is well worth studying for the many truly Shakespearean beauties it contains, if only one can overcome the sense of disgust which several scenes in the play tend to inspire. Once recognised as in the main Shakespeare's work, it is suggestive as to his character in youth, and as to the development of his poetic and dramatic instincts. Apart from direct suggestions of this sort, there is something singularly suggestive of Shakespeare's modesty at this part of his career, in his adhesion for the time to the older tragic style, which even then he must have recognised as distasteful, if not repulsive.

HAVE GHOSTS BEEN SEEN?*

EW subjects tax more stringently what may be called the scientific conscience than the matter of apparitions.

The student of science recognises two clear duties in all scientific inquiries. In the first place, he must strive to see things as they are; and in the second, he must speak of them as he sees them. Against strict obedience to the first duty prejudices of all sorts, shapes, and sizes often oppose themselves; but when he has resisted the temptations thus soliciting him to careless or sceptical or unfair inquiry, he is often still harder beset by the temptation to conceal views that he thinks may injure him either among fellow-workers in science or in the lay world.

In regard to ghosts and goblins, science has travelled along smoothly enough so long as apparitions of particular classes have been in question. The whole subject of hallucinations has been explored by science so thoroughly that no one now is perplexed by stories of visions such as those that troubled Nicolai, Blake the painter, Mrs. A. (of Brewster's "Natural Magic"), and a number of other persons. The vision in such cases is but "the blot upon the brain that *will* show itself without," and science is "not to be overawed by what it cannot but know is a juggle born of the brain."

Nor has science been much concerned about those old-fashioned ghost stories, telling how sheeted forms and unearthly sounds have affrighted sensitive folk under conditions suitably suggestive. We have learned to understand how readily under such conditions as the gloom of night, chilly air (starting shivers and tremors, which of themselves suggest unearthly feelings), and so forth, the mind will unconsciously form false images out of dimly seen objects, or transform unexplained noises into sounds significant of horror. A waving cloth becomes a beckoning sheet-clad ghost; the creaking of a door sounds like the shriek or moan of some one in agony. Out in the open air, in gloomy woods, or valleys half hid in mist, sights and sounds that by day would not be noticed are by the active mind changed to awful appearances or terrible noises.

To this day, for instance, in parts of England, the noises made at night by migrating birds are regarded as the barking and yelping of the Gabriel hounds ("Gabriel" is itself a suggestive transformation from "gabble"), which in recent times—I mean somewhere within the last ten or twelve centuries—have been found by the foolish country folk to be the souls of unbaptised children; while (since the hounds have never done any harm directly) it has been held reasonable to regard them as indicating some approaching trouble for those who may hear them.

There has not only been no trouble in interpreting the ghosts and goblins of this type, but no difficulty has arisen in consequence of visions and voices which have seemed to simulate the appearance or tones of the dead. Here the argument from coincidence, rather too freely urged about apparitions in general, may be safely used. Undoubtedly fancies of the kind described are so numerous, that we may fairly expect some among them to correspond (in the manner characteristic of ghost stories) with the supposed return of the spirit of the dead to his earthly home. Especially is this the case when we remember how such fancies are influenced by predominant ideas, and how, therefore, a person whose mind is full of the thought of some dear lost one would be more apt to form a mental picture of the dead friend or relative than of some form or face entirely unfamiliar.

Even where several persons have seen, or seemed to see, one and the same vision, science is at no loss to explain the illusion, because it is well known that the thought of one mind is suggested readily in such cases to another mind liable to similar impressions. Consider, for instance, the well-known story of the widower, who thought he saw in the dusk of evening the form of his late wife (only recently deceased) sitting in a garden chair; he called one of his daughters, and asked in awe-struck tones whom she saw sitting there? And the daughter saw her mother. Another daughter being called was similarly impressed with the thought that her mother sat in the chair which in life she had been wont to occupy; but when, summoning up his resolution, he went forth into the garden to speak to his "late departed saint," lo! he found not her in her habit as she lived, but her garden dress, which a maid had placed over the seat. It is obvious that the thoughts filling the mind of the father transformed a dress into an apparition, and it is probable that this thought was conveyed from his mind to his daughters', rather than suggested independently to them. In any case, there was no real apparition.

It is when we turn to visions of living persons, or to thoughts and suggestions relating to living persons, at a distance from the person affected by the vision or impression, that we find evidence most difficult to deal with, and the results not only difficult to explain, but not altogether satisfactory for discussion, because the number of those who welcome the discussion of all such matters, either with credulity or with ridicule, enormously exceeds the number of the more thoughtful.

The following is one of the best authenticated of a class of stories whose name is now becoming legion:—

In September 1857 Captain W., of the 6th Dragoon Guards, left England to join his regiment in India, leaving his wife at Cambridge. On the night between November 14 and 15, 1857, she dreamed that she saw her husband looking very ill, and she thereupon woke in great agitation. When she looked up she saw the same figure standing by her bedside. He appeared in uniform, and as if suffering intense pain. He then gradually faded from her view. At first Mrs. W. supposed she must still be asleep; but rubbing her eyes and listening to the breathing of a child beside her, she convinced herself that what she had seen was no dream. In December 1857 a telegram from the seat of war

here and let us make a bay." Shakespeare's love of hunting comes out most markedly in his earlier plays and poems, as in "Titus Andronicus," "Love's Labour's Lost," "Midsummer Night's Dream," and "Venus and Adonis."

* From the *Cosmopolitan*, a leading American monthly magazine.

appeared in the morning papers, stating that Captain W. had been killed before Lucknow on the *fifteenth* of November. The family solicitor applied for further information as to the date of Captain W.'s death, which Mrs. W. felt sure must have taken place on the *fourteenth*, and not on the *fifteenth*. But the date given in the telegram was confirmed at the War Office. At this time a singular circumstance came to light. The solicitor chanced to mention the case to a lady, a friend of his, who, according to his account, had a tendency to see visions. Turning to her husband, she said, "That must have been the same apparition I saw on the evening when we were speaking about India." They were able to fix the date, by means of a receipt for an amount paid that day, as the *fourteenth* of November. The solicitor on this applied to the War Office again, saying that the friends of Captain W. were persuaded there must be some mistake about the date. The officials stated, however, that there could be no mistake, since the death was referred to in two despatches from Sir Colin Campbell, who in both cases gave the date as the *fifteenth*. In March 1858 a letter arrived from a brother-officer, giving an account of Captain W.'s death. This officer, who had been riding beside Captain W. when he was killed, stated that death occurred on the *fourteenth* of November. Finally —though whether on the strength of this officer's evidence or through faith in the apparition's truth to time—the date was altered to the *fourteenth*.

It seems never to have occurred to any one to consider the difference between Indian and English time. If the time of Captain W.'s death really coincided, as Mrs. W. then and thereafter firmly believed, with the time of her dream, then, unless she went to bed unusually early, he was killed on November 15, Indian time. Suppose, for instance, she had her dream at ten o'clock on the night of November 14, then at that moment it was twenty-four minutes past three on the morning of November 15 at Lucknow. Supposing it was later, as the account suggests, then we may well suppose that daylight had already broken on the morning of the 15th at Lucknow, at the hour when Mrs. W. had her midnight dream at Cambridge and her husband met with his death.

One other narrative, before we consider the philosophical aspect of the multitudinous stories of this kind which are vouched for on good authority; and be it remembered, in passing, such stories as these can be unmistakably confirmed, and have frequently been so confirmed, independently of the veracity of the persons who assert that they saw the vision or experienced the impression considered. The following story is related almost in the words of the Bishop of Carlisle, better known in former days at Cambridge as Dr. Harvey Goodwin, the eminent mathematician :—

A Cambridge student had arranged, some years ago, with a fellow-student that they should meet together at Cambridge for the purpose of reading. A short time before going up to Cambridge to keep his appointment, one of them—from whom Dr. Goodwin had the story—was in the south of England. Waking in the night, he saw, as he imagined, his friend sitting at the foot of his bed. He was surprised by the sight, the more so as his friend seemed to be dripping with water. He spoke, but the apparition shook its head, and presently disappeared. But the vision reappeared a few minutes after. Information was soon received that at about the time when the apparition was seen by the young student his friend had been drowned while bathing.

It will be remembered that Lord Brougham had an experience very similar to the one just related; and there are other cases of the same kind—that is, cases in which an apparition of a distant friend, at or near the hour of death, has been seen by one to whom a promise had been made, the fulfilment of which had been prevented by death.

It must be admitted that, as the Bishop of Carlisle has said, the evidence in regard to apparitions of this sort is such as would be regarded as decisive in any matter of independent scientific research. The *à posteriori* evidence, in fact, considered alone, would be regarded as conclusive; it is only because of the strong *à priori* unlikelihood, amounting with many to the impossibility that such influences from a distance can be exerted under any conditions, that the student of science finds the force of the evidence weakening, not indeed absolutely but relatively, until he is almost ready to reject it as worthless, simply because of the inexplicable nature of the conclusion to which it points. This, however, no student of science—that is, of the known and the knowable—can honestly do. He must weigh the evidence in every case for what it is worth, quite independently not only of prejudices, but also of preconceived opinions as to the possible and the impossible.

After all, if *à priori* considerations are to guide us, we must remember the antecedent improbability that stories of this sort should be invented or should suggest themselves, even to the most imaginative minds. We can understand the origin of ordinary ghost stories, both those suggested by illusion and those resulting from imposture; but those stories of influences apparently exerted on persons at a distance, when either life is passing away or the vital powers are intensely affected by emotion, are by no means such as would naturally suggest themselves either to the fanciful or the inventive.

The coincidence explanation, which disposes fully of even the best-authenticated ghost and goblin stories, fails entirely in the presence of the phenomena we are considering. Professor De Morgan, a master of logic, long since pointed out its absurdity as thus applied. Among the multitudinous sights and sounds that, under favouring conditions, may be mistaken for apparitions and their utterances, a considerable number is bound to be strongly deceptive (the human mind being what it is), and there cannot but be some that seem to escape all explanation. But the special characteristic of the influences and appearances we are considering here is that they are so unusual as to convince the persons affected that something of a dreadful or most impressive nature has affected a dear friend or relative, and they are almost always, if not invariably, confirmed by the event.

If spectral appearances of the kind described were common, it might, of course, be justly reasoned that among such appearances some might be expected to correspond in time and circumstances (as in the case of the dripping spectre of the drowning man) with the death of the particular relative or friend seen, or in whom the person affected is most specially interested. But this is not the case. These experiences are so exceptional as to excite special attention when they occur; while, whenever they do occur, an event of a special kind occurs to correspond, both as to time and person. This being the case, the argument from coincidence, logically demonstrates causal, not casual connection.

But, as I suggested at the outset, the trouble is that we cannot understand how there can be any causal association in these cases. Nothing as yet known to the student of science enables him to explain how the anguish of A in one part of the earth can move B to sympathetic anguish in another.

I am utterly unable to suggest any explanation. The theory of brain-waves suggested by the present editor of the *Nineteenth Century* several years ago, in reference to a story related by Tennyson about an apparition of the kind we are considering, is simply no explanation at all. It is

an attempt to explain *obscurum per obscurius*. The only path to an explanation that seems worth trying is that on which Professor Barrett and others have attempted to advance inquiry—namely, as to the influence of mind on mind under test conditions. And unfortunately, while this path is infested by charlatanism and trickery, what has been thus far disclosed with more or less clearness in this direction has been of little promise. Like Sir Isaac Newton's experiments on the action of gravity under test conditions, which gave evidence only as to the nature of the attractive force exerted by matter on matter, but in no sense explained how matter can act on matter instantly over vast distances, so these experiments on the action of mind on mind within the same room, though useful as indicating the nature of this action, suggest no explanation whatsoever of the observed fact that mind can act on mind at a distance, and apparently in an instant of time.

In fine, it appears to me that the evidence regarding the communication of impressions from mind to mind over great distances, in such sort that apparitions of distant persons dying or suffering seem to be seen by their friends or relatives, is too strong to be rejected by any conscientious student of facts. Science is no more justified in rejecting this evidence merely because no explanation is available than astronomers would be justified in rejecting the observed fact that bodies influence other bodies from a distance, merely because, as Newton himself admitted, no one can explain how matter can act where it is not. Some communication there must be between sun and planet, between planet and satellite, and, beyond each solar system, between sun and sun and between galaxy and galaxy; but no one has yet shown what that communication may be. In like manner even the most cautious student of science may well believe that there may be some means of communication, under special conditions, between mind and mind at a distance, though no one may be able to explain how such communication is brought about.

VARIETIES OF AMERICAN LIFE.

AMERICANS are apt sometimes to be amused, and occasionally get rather angry, when they hear Englishmen who ought to know better blundering about American life, imagining semi-savage conditions in regions where culture prevails at least as fully as in the greater part of the old country, conceiving dangers from Indians where no Indians have lived for generations, and in general assuming that the wild ways of frontier regions continue in regions long since reduced to order and civilisation. I have been gravely asked whether it is not well always to be armed even in New York and Boston, whether in my Missouri home I felt safe from Indians outside the suburbs of St. Joseph, whether in my Florida home I am not in continual dread lest alligators should devour my children. And I have fancied that my answers have been doubted when I have replied that in all my time in America, from 1873 until now, I have never thought of carrying any weapon more effective than a pocket penknife (kept only for a penknife's work), that the nearest approach to an Indian I have seen within a hundred miles of St. Joseph has been an Indian negro half-breed working in my own stable, and very far from warlike in aspect, while in Florida I have only seen alligators when on board a launch or river steamer specially chartered for a trip, in which, if fortunate, an alligator or two might be caught sight of, lazily lying in some sequestered nook, and, even so, not safe from the hand of man.

But, although most of the ideas which untravelled Englishmen too commonly entertain respecting life in America, and especially in the far West, are absurdly remote from the truth, yet Americans are somewhat too apt to deny actually existent varieties of American life, which do unquestionably differ in marked degree from anything we have in the old country. An American fellow-passenger a few days ago (I write on February 1, and the conversation took place on January 24) so persistently claimed that no differences exist, that I took the first newspaper which came to my hands afterwards, viz., the *Chicago Tribune* for Sunday, January 25, and carefully noted all the paragraphs which indicated, as I think the English reader at least will perceive, the existence of varieties in American life for which in England, and for the most part in Europe itself, we have no counterparts.

I take these in the order in which I noted them:—

First. I read that at a meeting of Irish Volunteers, O'Donovan Rossa and Frank O'Byrne advised Irishmen to imitate the men who killed Cavendish and Burke, and to use dynamite. I do not read any expressions of abhorrence for the utterances of these shameless miscreants, or of disgust for the state of law in America which permits such utterances to be safely made in public. No nation has quite shaken off savagery in which such a thing is possible.

Secondly. I read news from Nogales, Arizona, of a fight in which the Federal troops, aided by a party of citizens ("most all the citizens" of the town where the fight took place "were engaged in it," says the paper ungrammatically), "whipped a band of Indians, killing three and wounding many, besides capturing five squaws and seven children.

Thirdly. At Amite City, Louisiana, a coloured man accused of an assault on a white girl, and lodged in gaol, is taken from the hands of the sheriff by a body of armed citizens (a highly respectable body we are assured, and we should imagine they must have been), and "hanged to a tree" a hundred yards from the gaol.

Fourthly. W. A. Pinkerton, of the Pinkerton detectives, captures a gang of train robbers who had "operated" in Arkansas and Texas. ("Operated" is good!) Among the multitudinous train robberies operated by this party one will strike Englishmen who are accustomed to attribute a certain degree of pluck to their kindred in America as remarkable, to say the least. A number of coloured men belonging to the United States army, officered by four white men, were on board a train attacked by three ruffian brothers named Burrows. Those gallant men, coloured and white, and a number of other passengers who were armed, allowed the thieves to rob the train undisturbed, and were themselves despoiled of their property and disarmed, their reason for this "calm, dishonorable, vile submission" being lest in the interchange of shots any of the women on board should be injured! Their rank cowardice might thus be extenuated, *possibly*, if the women had requested them to display it; but as a matter of fact several of the women on board expressed their indignation loudly. It is hardly necessary to say that train robbery, thus encouraged by the cowardice of passengers, remains a thriving business. I was travelling over the road where the robbery took place only a few days before; and so far as I can judge, if I had been one of the passengers, and cowardice had so far unnerved me that I could have joined those who advised passive submission on the part of four armed officers, a score of soldiers, and a hundred armed passengers, to three ruffians, I should have wished afterwards to be put carefully out of existence by some process such as my nerves (shown to be so weak) could comfortably bear—say laudanum. "Shamed life" must be a hateful thing to those four officers, at least.

Fifthly. A party of dunderpated Kentucky farmers arm

themselves to resist the survey of their county, and at the last reports much anxiety was felt for the safety of the surveying party. The party of farmers might probably be spared without much loss to the State.

Sixthly—a quainter circumstance than the preceding—Spotted Eagle and Charger, the defeated Indian candidates as delegates to Washington, sulk in their tents because of the election of One Feather, White Swan, and Crow Eagle. "Great excitement exists," the *Tribune* adds, "and news from Sitting Bull and Red Cloud is anxiously looked for."

Seventhly. American train robbers, captured when trying to rob a Mexican train, are sentenced to life servitude in the mines, instead of being shot after the usual Mexican practice. Naturally Americans feel honoured by the distinction thus drawn between American and Mexican ruffians.

Eighthly. A man who attempted to shoot the prisoner in a trial in the court of Judge Clifford, Chicago, is set free; and, so far as the report shows, is regarded as a suitable object for condolence and admiration.

Ninthly. A prominent citizen of Kalamazoo, Mich., is arrested for arson. This citizen was not only old and wealthy, but prominently pious—always a suspicious feature in an American. In fact, he was arrested while in church. Investigation showed that he had poured oil on the roof of another prominent citizen, for whom he entertained a feeling of dislike, and set the oil on fire. He may perhaps have misinterpreted in some degree the parable of the Good Samaritan.

Tenthly. Marshal Brown, of Chattanooga, Tennessee, had arrested Mr. Taylor Bowlin, who seized an early opportunity to call at Brown's place of business with the pleasing idea of shooting him. But the wary Brown "got the drop on" Bowlin, and, shooting him through the head, caused his death!

Eleventhly. In a row near Morehead, Rowan County, Kentucky, three men were seriously wounded. James Martin unwisely attempted to kiss Mrs. Walker, the hostess, which "she resented fiercely." In the *mêlée* (the reporter deems it quite unnecessary, it would seem, to explain just how the fierce resentment of Mrs. Walker developed into what Mr. Green usually calls a "melly") the lamps were overturned, and in the darkness several shots were fired. When a light was made, John Walker was found to be shot through the left lung, Pet Williams through the neck, and Ned Lawler through the abdomen. James Martin and Mrs. Walker do not seem to have been wounded. The paper simply heads the account "Lively Times."

Twelfthly. In the same county, a negro, Bob Yenders, suspected of an outrage, is visited by a party of the chivalrously dunderpated farmers who inhabit that region, and hanged to the beam above his door. But news being received just as Yenders was in the throes of death that one John Hooper was guilty, the wise farmers cut Yenders down—whether dead or alive the reporter does not think it worth while to mention. Any one who has had the opportunity of meeting some of the wiseacres who people this Boeotia of America need hardly be assured that not one of these murderously-minded farmers had the least idea that his conduct was wrong. Their compound of ruffianism and idiocy is regarded by many even of the better parts of the community as chivalrous. The so-called chivalry of the South is a strange blend.

Thirteenthly. From Indianapolis comes the news that the Democratic leaders of Indianapolis and of the State of Indiana feel strong sympathy for two men convicted of forging voting papers, and intend to stand by them! Such little foibles as forgery are regarded by many as mere indications of party zeal.

Fourteenthly. In Knoxville, Tennessee, three men accost Mr. Jas. F. Rule, the editor of the Knoxville *Journal*, with whose paper they were not content, and though he is accompanied by his wife, they invite him to the opposite side of the street, proposing there to assault and shoot him. "But i' faith he had been wiser than they"—for he had not only taken a pistol to church, but was ready to use it more quickly than they were prepared for. The result of this little Sunday scrimmage was that, although Mr. Rule was wounded, he was not badly hurt, whereas one of his three opponents was carried away in a dying state, and another was badly wounded. It suggests a curious picture of Knoxville Sundays to read that "the organ drowned the noise of the pistol-shots."

Fifteenthly. A woman of San Francisco, who had, for reasons unexplained, been known as "Dolly Adams," having died in China, a glowing account is given of her career, the most original feature of which was her marrying a high Chinese official, from whom she obtained a promise that if she died in China he would have her remains restored to San Francisco. "A few days ago, the body of the 'Water Queen'"—for so, as well as "Dolly Adams," this erst naughty lady was called—"was brought to San Francisco encased in a costly casket. But when we consider some of the ornaments of our national portrait gallery, we cannot find much fault with the treatment of celebrated *demi-mondaines* in the American press.

Sixteenthly. In Milltown, Indiana, a secret society of citizens (of course they are "highly respectable citizens") has undertaken the correction of social errors, such as San Francisco seems, on the contrary, rather to encourage. The members of the society call on a man who has not behaved quite fairly to his wife, and, tying him to a tree, give him "fifty lashes of hickory" (*sic.*) They then call on his neighbours and compel them to spread the news, on pain of being similarly treated.

Seventeenthly. And lastly (though from this one paper alone I could have taken a score more of such details), Collector Magone, of New York, dissatisfied with the immigrants brought in German steamships, sends a number of them back. Judging from some of the preceding cases, it would seem as though the stable-door were being carefully closed after the very undesirable intruders had driven the good steed away.

MORALS OF NOBILITY.*

By Grace Greenwood.

[THE following article by a leading and graceful American authoress presents a fair and interesting (in some respects a rather amusing) idea of the way in which English royalty and nobility are regarded in the United States by the less uncompromising Republican minds.]

During a golden autumn day, spent with some friends at Highgate, that most charming suburb of London, we were taken to see the quaint old place bestowed by Charles II. on his favourite of favourites, Nell Gwynn. It has suffered strange mutations since Nell's time, not the least strange being that it now has for a mistress a fair American, the young wife of Sir Sydney Waterlow. But Lady Waterlow does not dwell in the halls or wander through the grounds which once rang with the light laughter and lighter songs of the ex-orange girl, ex-actress, her royal lover, and his roystering companions. Ah, no! for the house has fallen

* From the St. Louis *Globe-Democrat*.

into dismal decay, while the grounds have, through years of neglect, become a tangle and labyrinth of shrubs and vines, like to the magic-guarded gardens of the Sleeping Beauty. Indeed, so rank is the growth of untended flowers, fast relapsing into primitive barbarism, so insolent the spread of weeds, so still and slumberous the atmosphere of this enchanted bit of the past, standing at bay against the mighty roar of the fast-advancing town, that one could easily fancy Nell yet in her quaint bedchamber, sunk in her prolonged beauty-sleep, but, perhaps, just ready to wake, take a bath in her shallow marble tub, array herself in rich stuffs and colours, just come again into fashion after two centuries, and start out on a new career of conquest. The court proper, or the proper court, would not receive her, nor even the demi-court of the heir-apparent, openly; but the stage would be more than ever open to her. She would probably come to

> the West,
> To dazzle when the sun is down,
> And rob the world of rest,

revel in Republican homage, and roll in "greenbacks," like to other pretty favourites of princes.

The Merry Monarch was very fond of this Highgate place —pleasant and cosy, but never luxurious—and with it is connected a significant little story. One morning, as Charles was strolling up and down the brick-paved terrace, with his usual bodyguard of little long-eared spaniels, Mistress Eleanor Gwynn appeared at her chamber window, holding in her white, dimpled arms a pretty baby, who much resembled the King—

> With the self-same eyes and hair.

More than once the proud mother had solicited for him a ducal title and estates to support it, but her liege had put her off, fearful of establishing a precedent which might stain the royal prerogative and exhaust the royal treasury. Now, looking down from the window, and holding forward the child, she cried, "A title, your Majesty, or out goes the brat!"

The indolent King was alarmed for his beautiful boy, and instantly exclaimed, "Save the Duke of St. Albans!"

Some of England's noblest titles and estates have had their origin in some such ignoble way, and date directly back to honours and rewards bestowed by profligate kings and princes on low-born courtesans and their "brats." The blue blood of Britain is not altogether cerulean, but has now and then a very earthly tinge. The scandals which so frequently disgrace the highest English society and shock the world are outbreaks of the cancerous corruption of past generations. Yet the royalty of to-day, not only of England, but of Continental kingdoms, is certainly more decent and decorous than that of less than a century ago—if it is not absolutely more virtuous. In England this improvement is, of course, largely due to the example of the "virtuousest, discreetest, best" of Queens. Her Uncle William had his palace well stocked with and his Civil List well burdened for his natural children; her Uncle George was, as all the world knows, the greatest of royal voluptuaries and libertines, and even her venerable grandpapa had in his youth his princely peccadillos. It is, perhaps, an open question whether the royal and ducal folk of old times, who handsomely provided for their mistresses and boldly acknowledged and ennobled their illegitimate children, were more immoral than those of our day, who conceal irregular relations and ignore their unhappy consequences; but about the honesty and manliness of the two courses there can be no question. It may be that the growing restiveness of that once stupid animal, the taxpayer, has something to do with the decrease of royal profligacy.

Seen under the white light of absolute morality, I cannot claim that the daily walk and conversation of the popular Prince of Wales presents a lofty example to high English society, yet I do not believe him the Don Giovanni or Sardanapalus he has been represented. He possesses too genial, kindly, and frank a nature and too much good sense to attempt a prince regent rôle; that is played out. And then he is too busy with bridge and park openings, and exhibition inauguratings; he is whirled from banquet to banquet, from chair to chair; he is waltzed through galleries, is called to wrestle with Albert monuments and statues and multitudinous busts. It seems to be the policy of the Queen and her advisers to keep the royal family "to the fore," to have not only the Prince of Wales, but all his brothers and sisters, nephews and nieces, act up to the "Ich dien" motto—serving the people in all proper ceremonial ways—and the people work them well. Last summer the three-year-old Duke of Albany actually laid the foundation of a public building, and did his "level best" with his little trowel to prove to British taxpayers that they were getting their money's worth out of the Guelphs.

Unquestionably the English royal family of to-day is an improvement on that with which the century opened. On the morals of the sons and daughters of George III. history is reticent, and will be during the life of the good Queen; but I am afraid that there was scarce a man or woman of the whole big family whose character should be discussed except *in camerâ*. Albert Edward is like to the long run of Princes of Wales since Edward, born at Carnarvon; there has probably not been a Joseph among them; but no great scandal has attached to the lives of the Queen's other sons. The Duke of Edinburgh is said to be too parsimonious to be profligate, while the Duke of Connaught is too domestic —too like his father. Oddly enough, the only exception I remember was in the case of the late Duke of Albany—reverenced by loyal English people as a saint and by his elder brother's gay associates pronounced "a muff." It was whispered that he had in the sunny South a questionable and sad little romance, and that it had to do with his untimely and sudden death. But I don't believe it. No Guelph ever committed suicide

Leaving aside the deeper question of personal morality, the most serious lacking in the character of the Prince of Wales is the lack of seriousness. He is a man who, of all things, loves to be amused, and who is not overscrupulous as to who or what amuses him. In his visits to Paris he frequents the Palais Royal and Opéra Bouffe, and between the acts drops into the *loges* of the prettiest and gayest of the artistes. This habit is so notorious that Zola did not hesitate to put him into the dressing-room of his beautiful and terrible "Nana." In London comic actors, singers, and personators, all sorts of "funny men," and bright, original, witty women are sure of his gracious patronage. He finds high tragedy, even when superbly presented, as at the Lyceum, "slow," and classical German music—even the compositions of his lamented father—a bore; while, when he goes to grand opera, he generally goes to sleep. He is royally fond of good living, the turf, and all sorts of sports; is a great slaughterer of pigeons, and once shot a corralled elephant. He has a quick eye, and a passionate admiration for beauty. He entertains munificently, but his guests, even when foreign princes, are generally respectable people. The clever men and pretty women of inferior station, or no station at all, whose acquaintance he wishes to make, he manages to have invited to the house of some obliging friend, where he meets them. One of the best things I know of him is his hearty liking—something as near friendship as a prince is capable of—for certain beautiful countrywomen of ours, whom he has felt compelled to respect. I

will instance Miss Anderson, Mrs. Potter—yes, and lovely Miss Jenny Chamberlain. To none of these has the flattering regard of this middle-aged "Prince Charming" been a real benefit, perhaps, but I believe it was an honest and loyal tribute to beauty and genius. The Prince is beyond question kindly and generous; men of his set pronounce him "a capital good fellow;" but, Republican as I am, it seems to me that the heir to the proudest and noblest Crown in the world should not be any fellow's "good fellow." If anything could sober the man, even after a wild youth, it would seem that a time like this were enough —a time when the rising tide of popular disaffection, the sullen, miry tide of desperate want, is lapping against the steps of the throne—when the political sky of all Europe is black with threatening and lurid with portents.

In his marriage the Prince of Wales has no advantage over his brothers, except in the popularity and beauty of his wife. The Duchess of Edinburgh, though little liked in England, is a woman of strong character, rare intelligence and dignity of demeanour; the Duchess of Connaught, an excellent little creature, and no fool, holds her husband's heart in spite of her exceeding plainness; while the Princess of Wales, amiable, graceful, and gracious, is rather negative in character. She is preternaturally young, with no trace of sorrow or trial, or even thought, in her pretty, placid face; fond of amusement, frankly frivolous, and not too jealous of her dignity. In fact, the charming royal matron yet retains all a pretty girl's love of admiration, dress, and adornment.

It is little wonder if in these critical times serious English people look forward with some apprehension to the coming to the throne of this pair of perennially youthful pleasure lovers. They may love and admire, but they do not wholly trust them. They fear that the court of the future reign will be rather a mercantile than a moral advantage to London; that in it science, literature, and art of the highest character, great public enterprises and schemes of education and benevolence will find even less aid and comfort than in the present melancholy, migratory, and miserly court; while through its favour will flourish mightily costumiers, milliners, and tailors, funny men and horsey men, French *comédiennes* and singers, and American champion shots, showmen, swimmers, and pugilists.

On the second Sunday in December good English churchmen must have prayed with unusual fervour for the Queen long to reign over them, steady and stolid, proper and pious as she is, for the mischievous little bird of the telegraph must have carried to the remotest parts of the kingdom news of the interview between the British heir-apparent and a notorious American prize-fighter. The account of the courtesies exchanged between these two powerful personages, in which the Irish-American did not by any means take a secondary position—the report of the conversation, liberally spiced on both sides with the slang of the ring, and preceded and followed by "hearty hand-shakes" must have been tough reading for aristocratic and refined Conservatives. Yet I am afraid there is not among the entire English aristocracy a peer or a prelate too proud to kiss the hand of his Royal Highness after the grip of Sullivan the slugger.

But we republicans should not be troubled. The less the Prince realises the mighty responsibilities and magnificent opportunities of his own position, the more he cheapens royalty through such unworthy associations, the better for the principles of democracy and equality. Let him continue to make light of his dignity and his destiny a few years longer, and a great change must come either in him or the entire system of English sovereignty. This is an age of miracles; the saving change may come in him, and he may yet show himself as moral and as mean as "Prince Hal," who as Henry V. publicly cut poor old Jack Falstaff, and, "unkindest cut of all," preached to him like a Salvation Army exhorter. But that Prince of Wales was still young when he turned over a new leaf in history; this one has passed the age at which his father ceased from his virtuous labours, so is little likely to pose for posterity as Albert the Good II.

WATER MYTHS.

By Stella Occidens.

AMONG the ancients the seas near shore were supposed to be inhabited by beautiful beings called Sirens or sea-nymphs. They had the power of charming all who heard them by the sweet tones of their voices accompanied by irresistible strains of music. We are told in the well-known story of Ulysses that Circe warned him against these beings. Some of his men fell victims to Scylla, the once beautiful water-nymph, transformed into a horrible monster on account of her indifference to the pleadings of the fisherman Glaucus. Ulysses again encountered danger whilst passing the isle of Calypso. Homer thus describes the beautiful grotto in which she entertained the hero:—

> A garden vine, luxuriant on all sides,
> Mantled the spacious cavern, cluster-hung
> Profuse; four fountains of serenest lymph,
> Their sinuous course pursuing side by side,
> Strayed all around, and everywhere appeared
> Meadows of softer verdure purpled o'er
> With violets; it was a scene to fill
> A god from heaven with wonder and delight.

Calypso urged Ulysses to remain with her, but he longed for his home, and, compelled by a command from Jupiter, she allowed him to return. She provisioned a raft for him, and all went well at first, but presently a storm arose, and the raft was destroyed. A sea-nymph took compassion on Ulysses, and, in the form of a cormorant, alighted on the raft and gave him a girdle which enabled him to reach land.

Thus some of these sea-nymphs were regarded as destructive, whilst others helped mariners. Among the beneficent nymphs was Ino, the daughter of Cadmus, who was made goddess of the sea by the gods. She had cast herself into the sea from a high cliff, with her little son Melicertes in her arms, whilst pursued by her husband Athamas. In a fit of madness he had slain his son Learchus, and she feared the same fate for her only remaining child. She became the protector of sailors, and saved them from shipwreck.

In Norse mythology Ægir is the divinity of the sea, and Ran is his wife. She has a net in which she catches shipwrecked mariners, and she claims their bodies whilst their souls go to heaven. Ran has nine daughters, the waves who assemble together as their father wishes. They have long golden locks and flowing white veils, and they are called billows or surges when the wind blows. Then they lash themselves against the shores and on the rocks. They rest on a hard rocky bed, and do not play in calm weather. The names of these daughters vary according to their appearance. Thus they delight in such names as Billow, Raging-sea, Sky-clear, &c.

In Danish mythology we have the pathetic story of the little mermaid who saved a prince from drowning when his ship was wrecked. She swam with him to shore, and laid him in the warm sunshine. But a great yearning filled her soul for the beautiful prince, and from that day she longed to see him again. At last, after great trials, she obtained her wish, but withal lost her beautiful voice.

She charmed the prince with her beauty and grace, but did not win his love. He married another, and her little heart was broken. She became a Light-elf, or spray of the ocean, and immortal.

The German tradition of the Lorelei is quaintly beautiful. In days of yore, a charming maiden lived on the rocks known by this name. She sat on them every evening and combed her golden locks, or played strains on the lute, accompanying the sweet tones of her voice. Many were lured to their destruction by approaching too near. The son of the Pfalzgraf longed to see her, and as he approached the rocks she appeared, dressed in white and veiled. The youth leapt into the waters so as to reach her, and was drowned. His father sent soldiers to take her prisoner, but, on their approach, she threw herself into the Rhine, singing—

Hasten hither, lovely waves,
Take me quickly to your caves!

The waters rose, and two waves bore her away whilst she still sang, and the Undine was never seen again.

It is related that at Bacharach there dwelt a beautiful maiden who was much sought after and admired. She would not accept any of the numerous suitors who loved her, because she loved and waited for a brave knight who had gone to Palestine. She caused so much love and jealousy that complaints were made to the Archbishop of Cologne. He told her he would take her to a place where she could await her lover, or, in case of his death, take the veil.

She was escorted by three knights, and when she came to the Lorelei she ascended the rocks to take a last look at the Rhine. In the distance she saw a boat bearing her lover, and, overcome with joy, she fell on her knees and extended her hands towards him. He saw her, and, whilst gazing at her, his boat was caught in the whirlpool and suddenly disappeared. As all gazed in horror at the spot, a pale figure with fair hair appeared on the surface of the water. Then the maiden, with a cry of despair, leaped from the rock into the water where her lover had sunk, never to rise again. They were afterwards found locked in each other's embrace. This event confirmed the belief in the existence of the Nymph of the Lorelei.

A similar legend is told about a gloomy lake called the Wildsee, not many miles from Baden-Baden. Here dwell water-sprites, who spend their days on its banks, weaving garlands, playing on their lutes, and singing—enchanting unwary travellers. A young shepherd-boy once heard a beautiful strain of music, and, approaching the lake, saw the fair singer. He gazed spell-bound, as she played on her harp. As soon as she heard his step, she gave him one glance, and then sprang into the lake. That glance drove him wild, and he wandered from place to place, but after a time disappeared, and was never heard of again.

The waters of the Mummelsee, a large lake not many miles distant from the Wildsee, are generally calm; but at times, when the day is most peaceful, the lake is covered with billowy waves. Here, according to ancient tradition, dwell beautiful Undines, who are formed as if of snowy lilies, with the exquisite blush of a delicate rose. Every month they rise to the top of the lake, and revel in the moonlight, sitting on the rocks, and combing their flowing locks. As the first streak of dawn appears they have to return to their home, otherwise an ugly old water-dwarf orders them home, and they dare not disobey him.

A French legend tells the story of a cloud-maiden, a kind of mermaid, called Melusina. Raymond, Count de la Forêt, of Poitou, having unfortunately killed his patron during a hunting excursion, fled into the deepest recesses of the forest. After wandering for many hours, he came to a pleasant glade, illumined by the moon. In the midst bubbled up a limpid fountain and flowed away over a pebbly floor with a soothing murmur. Near the fountain-head sat three maidens in glimmering white dresses, with long waving golden hair and faces of inexpressible beauty.* One advanced towards Raymond, who was so charmed with her beauty that he became betrothed to her before daybreak. She became his wife with the restriction that she might pass Saturdays by herself. This was agreed to, and for a time all went well. One day, however, the Count, unable any longer to restrain his curiosity, broke his promise, and made the discovery that his wife, during the time thus given to her, was transformed into a mermaid. He said nothing about the matter until one day when, being angry with his wife, he reproached her for being "a vile serpent, contaminator of his honourable race." Casting on him a pitiful look, she disappeared for ever from his sight through the castle window. It it said, however, that whenever one of the Lords of Lusignan is about to die she hovers about the castle, moaning like a banshee.†

The story of Undine is somewhat similar to the above; but she marries the knight Huldebrand in the hope of obtaining a mortal soul. A Flemish legend tells of three Nixies who came from the waves of the Meuse and danced with the villagers at their vintage-feast. They sang and danced most gracefully; and one of them, whilst dancing, took off her gloves and handed them to a peasant. When the clock struck twelve, the Nixies hastened away, but the unlucky one who had taken off her gloves could not find them again. She hastened away without them, but next morning the waters of the Meuse were blood-red, and these water-sprites were never seen again.

Among the peasantry of South Russia exists a belief in water-nymphs resembling the Nereids of Modern Greece and the female Nixies of Europe. In the Skazbas mention is often made of beauteous maidens who live beneath the waves, but can transform themselves at will into birds, and fly wherever they please. They often appear as ducks, geese, and other birds of the same species. They are the daughters of Morskoi Tsar, or Water King, who lives in a beautiful cave under the waters. At times he comes forth to seize a human being, generally a boy, who eventually marries one of his daughters. They escape to the upper world, but with much difficulty.‡

A story is related about a prince, who, on account of a promise made by his father, was obliged to surrender himself to the Water Giant. He fell in love with a beautiful maiden, who lived in the king's palace, and whom the king had stolen. She transformed herself into a ring, which the prince carried about with him until he escaped from the Water King, and then the fair maiden became his bride.§

Water-nymphs are also referred to in the mythology of the Western hemisphere. Many stories are related about them among the Red Indians. The Ottawas tell of a woman called Monedo Kway, who had a beautiful daughter. She was so handsome that her mother feared she would be stolen, so she put her in a box on the lake, and tied it by a string to a stake on the shore. Every morning the mother fed her daughter, and combed her long shining hair. Notwithstanding the mother's great care, her daughter was stolen by a superannuated old spirit called Iskhwon Daimeka, who married her. After three years a storm arose, and the waters destroyed the old spirit's cabin and himself, and bore the foam-woman home to her mother. But, alas! her beauty had now left her, and the mother had no longer any reason to fear that she would be stolen.‖

* Baring-Gould, "Curious Myths," p. 343.
† Fiske, "Myths and Myth-Makers," p. 97.
‡ Ralston, "Russian Folk Tales," p. 130. § Ibid. p. 143.
‖ Schoolcraft, "Hiawatha Legends," p. 213.

In Florida a beautiful legend is related about Wenona, who loved a warrior named Chuleotah. Unfortunately he belonged to a tribe at war with her father, and during a great fight the father killed him, bringing home the head as a trophy. When Wenona gazed on the well-known features, she fled from home, and cast herself in despair into a lake, now called Silver Lake.* She still lives there, and on a very clear day, when the waters are shallow, her beautiful palace can be seen. Her hair is the green moss that floats in the water.

SCRATCHING IN THE ANIMAL KINGDOM.

By Professor Samuel Lockwood.

FOR nearly two weeks, one midwinter, my studies were pleasantly interrupted by a nightly visit of that funny arachnidan, *Phalangium dorsatum*, Say. We often hear it called Daddy-long-legs, which name in England is given only to the long-legged dipteran, the *Tipula*, or crane fly. My visitor's domicile was a nook somewhere in the library. As appearances are often deceptive, it would not be safe to predicate a literary taste of my bookish visitor, but the creature's measured gait and pedal sprawl over my written page did suggest the airs of a stilted critic. And yet, to use a trade-phrase, with all its seeming bigness, phalangium did not "size up much." Its egg-shaped body was exactly a quarter of an inch in length, and an eighth wide at its thickest part. Of its eight legs, each one in the shortest pair measured an inch and five-eighths, and in the longest pair the measurement exceeded three inches, a considerable spread for so little timber. There was quite a good understanding between us. It would allow me to touch the long, thread-like legs with my pen, and even to lift one up above the others, and the queer thing would keep the limb raised for several minutes, precisely as I would leave it, as if it were hypnotised.

The phalangium is a member of a tribe of the spiders known as the *Pedipalpi*, because the palps or feelers end, like the feet of many insects, in a claw, sometimes a pair, thus making a forceps. After my tickling his perambulators, Daddy seemed to have got his ideas started, for, having adjusted his octapodal highness upon my manuscript in most admirable equipoise, he began the delectable exercise of scratching his legs. I am sure that the operation was enjoyable to him, while to me the sight was very interesting. If Captain Cuttle should find it necessary to try the flexibility of a whip-stock, it is supposable that he would take the handle in his left hand, and with a pressing motion pass the whip for its entire length through the iron hook which served for his right hand. The whip would thus take on a loop-like curve, and would straighten itself out with somewhat of a snap. Just in this way did my spider scratch his slender legs—for one at a time were these long elastic limbs passed through the hook of the palp, when the limb would be bent like a loop or bow in the process, and as it left the hook or claw by its elasticity would do so with an almost whip-like snap.

The higher one ascends the animal scale in such observations, the more pronounced is found this habit of scratching the skin surface of the body. Individually, Maud S. and Coomassie may be "too high-toned" for such a practice. But these creatures are coddled out of conscience by the groom, who has the comb and the brush almost always on their pelts; hence, if these "high bloods" come not to the scratch, it is because the scratch comes to them. Cushie and Dray, put upon their own resources, enjoy hugely a good rubbing self-administered against a tree or post.

Happening one day in my lady's boudoir, I picked from the cabinet what I took for a pretty bit of *bric-à-brac*. It was an ebony stem, about fourteen inches long, not thicker than one's finger, and quite daintily turned. At one end was attached a pretty little hand deftly wrought in ivory. It could not be called a fist, for I noticed that the fingers were only half closed. The nails were well developed, and their ends or edges were set in a line. This artistic trifle seemed to me made for some special purpose. A whisper from a friend enlightened my wonderment—"A back-scratch." I caught at once. Now, I have read of a toy formerly common in England, which at fairs or upon occasions of a crowd would be passed over the back of a rustic, when it made a noise like the tearing of cloth, and suggestive of a rent behind, to the poor man's dismay. This, too, was called a "back-scratch." But that was simply the vehicle of a bit of mischief. My lady's back-scratch was for use in that very much out-of-the-way place between the shoulder-blades. This handy implement, though an article of *virtù*, was in the line of luxury, although the amenities would hardly approve the indulgence before eyes polite.

The above reminds how gingerly and faulty the treatment of the word is by the lexicographers. One would think it only meant to abrade, lacerate, excoriate, whereas how common the usage by which it signifies to titillate with mild friction! The Latin expresses the action nicely, *scabere cutem leviter ungue*, which in good English is simply —to rub the skin lightly with one's nails. Pliny has *aures pedibus*, scratching the ears with the feet, which suggests the experience of that tourist in Italy who rode a mangy mare. The beast had a bad habit of stopping to scratch her ears, and, the hind-feet being used for that purpose, the thighs of the rider received all the benefit of the operation, which, like tickling with a brickbat, was too crude for real comfort. But the ungulates generally are bunglers at this trick, though not insensible to opportunity, as witness when our neighbour's cow got into the lawn, and, wild with delight, went tearing through the soft evergreens, our pretty arbor-vitæ trees, which was so much nicer than rubbing against a fence.

It behoves to confess that Nature has been a niggard in this matter unto man, having done less for him in this line than she has for the beasts that perish. "The paragon of animals" is the victim of irritation from eczema in a hundred forms and degrees. Though having already thrown a stone at the lexicographers, here goes another, for we must cite from memory that churlish dictionary-maker, Dr. Johnson, who wrote in the first edition of his dictionary, "Oat—a grain used in England to feed horses; in Scotland, men." This was very unbecoming. But the food has much to do with the condition of the cuticle. Hence we put together the Scotsman's "oaten cakes" and the legend of the benevolent nobleman who set up scratching-posts in the streets of Edinburgh, and the canny benediction of each user of them, "God bless the Duke of Argyll!"

On the physical or rather physiological side of the question, a good deal might be said for this mild friction of the skin. Near the surface—that is, just under the scarf, or epidermis—the capillaries, almost microscopic blood-veins, abound in well-nigh infinite numbers. Each of these minute carriers or distributors of the crimson life-stream has along its sides its complement of nerves nearly parallel. Between these nerve-fibres lies the undifferentiated protoplasm, or life-stuff, which is the supply of constructive matter for the use of these tiny builders, for out of this life-

* Silver Lake is a short distance from Ocala in Marion County, North Florida, and is quite a well-known resort.

matter, or bioplasm, each cell is built. But even mortar may need quickening—so this life-stuff may become too passive, that is, *quasi* torpid. These nervous fibrillæ are the electric wires, and gentle friction is the dynamo to generate the mysterious fluid and quicken the conductivity along the lines.

Strange to say, this scratching has also its psychological side. Let a puzzle be propounded, and why on the instant does the nonplussed one institute a rummaging for an idea in the hirsute thatch of his cranium? And everybody does it, even he "of the front of Jove himself" more than the beetle headed clown. We asked an explanation of our encyclopedic friend who "knows it all," and quoted to him the well-worn distich :—

> Be mindful, when invention fails,
> To scratch your head and bite your nails.

Upon the word he began dishevelling his carefully brushed hair, saying it was "a poser," and, by way of compliment, that it "was not slow"; to which our response, "No, it's Swift": at which he laughed, though he had quite missed the point, for he rejoined that he always thought us "a little fast."

It is truly wonderful how lavishly and admirably Nature has gifted many animals for this very exercise of scratching lightly with the claws. At my feet lie Tom and Dick, two good friends. The former is a fine young Maltese, the latter an old black-and-tan. The cat's claws are very sharp, the dog's are less so. Both animals are clean and in good condition, yet both appear to take delight in a good scratching at the back of the head, and especially behind the ears. The hind-foot is the instrument used, and with what delicacy—yes, nicety, or precision of adjustment! So rapidly does that foot move, that it makes a fan-like shadow; and so exact the distance at which the keen, protruded claws are set, that it secures only a delicate touching of the parts, producing the pleasant titillation of the tonsorial brush. Any coarser adjustment of those needle-pointed hooks and the blood would flow from the lacerated skin.

But, even more than with the mammals, is this cuticular titillation a necessity with the ordinary fishes; and, since they have neither hands nor feet, how is this want in their case gratified? I have witnessed the operation many times, yet fear a failure to adequately describe it. The scaly coating of a fish needs an occasional cleaning, as does the copper sheathing of a ship; for, with both, a foul surface impedes progress through the water. On each side of a typical fish is a thin line, known as the lateral line. It is, in fact, a mucous canal, from which issues at the will of the animal a lubricating fluid, which, spread over its scaly sheathing, lessens friction, and so facilitates movement in the water. This mucous line is made up of rows of pores, which communicate with the slime-secreting glands. Leydig discovered that each of these oil-producers had its own nerve, thus constituting a series of sense-organs. And very delicate is their sense, as by them the fish gauges the weight of the water-mass, also the direction and resistance of currents. But associated with these nerves, arranged in tufts or buttons, are air-cells; hence it seems certain that the fish is able to appreciate vibration in water, whose wave-lengths are larger than are those of sound. The faculty of appreciating the waves of light we call seeing, and similarly of sound, hearing, whose waves are much larger than those of light. But our scaly subject is endowed with a third wave-measuring sense, in which possession it out-paragons "the paragon" himself. It can appreciate the trills or waves of water vibration, and of this faculty our language has no word to express the name.

Now these oil-yielding tubes above described may get clogged, or the glands become torpid. Here, then, are sense-organs to declare the state of affairs. Hence arises the necessity for the animal either to clean off its body armour or to stimulate into activity the indolent organs. And, in fact, in other ways, fishes have their own eczema, or diseases of the skin. Sometimes there is a blistering or deterioration of the cutis, and sometimes a species of *Saprolegnia*, a fungous parasite, sets up a flocculent growth on the cuticle. For any of these instances friction is the only remedy, and its exercise is unquestionably pleasant to the fish.

But how can a fish scratch itself? Sometimes in the way of Cushie, as when she rushed through the evergreens. So a fish will often dart through a dense clump of soft water-weeds. But this amounts to little else than a gentle titillation. The scaly sheath is not to be cleansed so easily. I have seen the performance many times, and by several species, but none have so much interested me in this respect as the sunfish. Take the one best known to the pin-hook anglers, and often called "pumpkin-seed." There is a boulder with a smooth, clean surface. The fish is steady; its big eyes seem of a sudden to glow with a blue light. Every fin is set, even to the dorsal, which bristles with its keen spines. The fish seems aiming for that stone. The propulsion must come from the caudal and the side fins, but mostly from the former. All these give a simultaneous blow against the water; at the same time, as if it were in the way, the topsail—that is, the dorsal—falls and is snugly reefed. All this is done in a moment, and such the force that the fish truly darts, threatening to butt its nose against the rock. The speed is high, but, just ere the rock is reached, there is a marvellously sudden bend of the body, the most convex point being the exact spot which is to be scratched. Though very rapid, so well-timed is the movement, and so nice the adjustment of the position, that the pressure or amount of rub or friction is correctly received, and the point of impact is precise, and the body glances from the rock. The collision is so accurately gauged that no harm is done. And similarly, and with a great variety of ingenious posturing, the fish subjects all parts of its body to this treatment. It even contrives to scratch the top of its head, by bringing the desired spot into the proper position at the precise moment of the glancing impact with the stone. The feat is delicate and deftly, as if an acrobat should in his somersaults comb his hair against a rock with no harm done every time.

Having enjoyed the use of a large aquarium for the study of fishes, it has been an object with me to anticipate their wants. Hence I have purposely given them scratching-stones properly adapted to their needs. I was surprised that a favourite object for this purpose was a large live river-mussel, the *Anodonta ecurvata*. The corrugations of the shell, which mark its growth, form a series of smooth ridges, upon and against which, with their contortions of twists and bends and tilts, these fishes glance in scratching themselves. As to ichthyic emotion one cannot say much. That they enjoy these exercises I am sure; and I almost think they know their benefactor, for they come at his call at feeding-time—though up to this present writing I have not observed anything that might be interpreted as a grateful recognition of benefits conferred; certainly nothing commensurate with the canny benediction, "God bless the Duke of Argyll!"—*Popular Science Monthly.*

An Indiana Monstrosity.—A two-headed child, near Princeton, Ind., was born on January 9 to the wife of Henry Wilson, a farmer living four miles from that city. It had two well-formed heads, one just behind the other, and weighed twelve pounds. The strangest feature about it was that the heads were covered with hair three inches in length. The front head was more perfectly formed as to features than the one behind, which had only an indistinct nose and mouth. The child only lived a few minutes after birth.

THE STARS OF OTHER TIMES.

THERE is a strange charm in contemplating the star-strewn heavens, with the thought in remembrance that as the constellations are now, so were they in all the past ages over which history extends its survey, and beyond them through the ages when man himself had scarcely begun to exist as a reasoning race, and in ages still more remote when this earth was inhabited by millions of living creatures, but by none who could think about the wonders surrounding them. Here and there a few stars have changed in lustre; new stars have appeared and old stars have vanished; the swifter motions of a few (including some of the chief brilliants of the heavens) have carried them to new positions among the star-groupings, but in the main the scene presented by the star-strewn heavens now is the same which was presented at the beginning of the Christian era, the same which Ptolemy and Hipparchus surveyed, the same which the builders of the Great Pyramid studied more than five thousand years ago, the same which the first races of men contemplated with slowly growing intelligence, the same on which the eyes of all animal races must from time to time have been turned during the millions of years which have elapsed since life began upon this earth.

Yet the aspect of the constellations, as seen from particular latitudes or positions on the earth in long past ages, differed notably from their aspect as seen from such places now, even though the actual configuration of the star-groupings was the same. The constellations being carried round the polar axis of the heavens by the diurnal motion, take varying positions above the horizon of any latitude, these positions depending upon the position of that axis, which is coincident, of course, in direction with the axis of the earth. And owing to the reeling, or gyration, of the earth's globe, her axis is constantly changing in direction. It is inclined about $23\frac{1}{2}°$ to a perpendicular to the plane of the earth's path, and thus, neglecting slight changes in the position of this plane, the points on the heavens to which the earth's axis is directed—that is, the poles of the heavens—travel in circles about 47° in arc-diameter around the poles of the ecliptic, the period of circuit being about 25,868 years. This suffices, of course, to modify very largely, in long periods of time, the aspects of the constellations, themselves unchanging, as they are carried by the diurnal motion across the sky. The present north pole of the heavens, for example, which lies due north about $51\frac{1}{2}°$ above the horizon of London, was more than 47° from the point in the star-sphere which was the north pole 12,934 years ago; so that at that time the present pole-star (not quite coincident with the north pole, but near it) was carried round the actual pole in a circle 94° in arc-diameter, ranging from an altitude of 4° or 5° above the northern horizon to an altitude of 81° or 82° above the southern horizon. Not only have the movements and positions of individual stars been thus modified, but the positions of star-groupings, when most favourably situated for observation, have been so modified as in many cases to make it difficult for us to understand how men in old times came to imagine resemblance between star-groupings and various objects, animals or otherwise, where now no trace of resemblance is suggested when those star-groups are studied as actually seen in the heavens.

It has seemed to me that it would be interesting, and might lead to results of considerable scientific and even historic importance, to prepare a chart by means of which the exact aspect of the heavens as seen at any hour of any night in the year, from any given latitude, at any epoch in the past or future, might be readily determined. All the maps hitherto constructed to illustrate the effects of the precession of the equinoxes have shown no more than the movement of the north pole of the heavens around the north pole of the ecliptic. What seemed wanted was a map from which the position of the equator at any epoch might be obtained at once; and thence, by simple constructions, any further information which might be required respecting the appearance of the night skies at different hours and seasons at that epoch.

The accompanying map is the northern map of a pair which I have drawn for this purpose. (The southern map is already engraved, and will appear next month.) It is simply a stereographic map of the heavens to a distance of 100° around the north pole of the ecliptic as centre. Thus the Zodiacal zone is the outer zone—20° wide—of the map; and the circle $23\frac{1}{2}$ in arc-distance from the centre of the map represents the apparent path of the pole of the northern heavens.

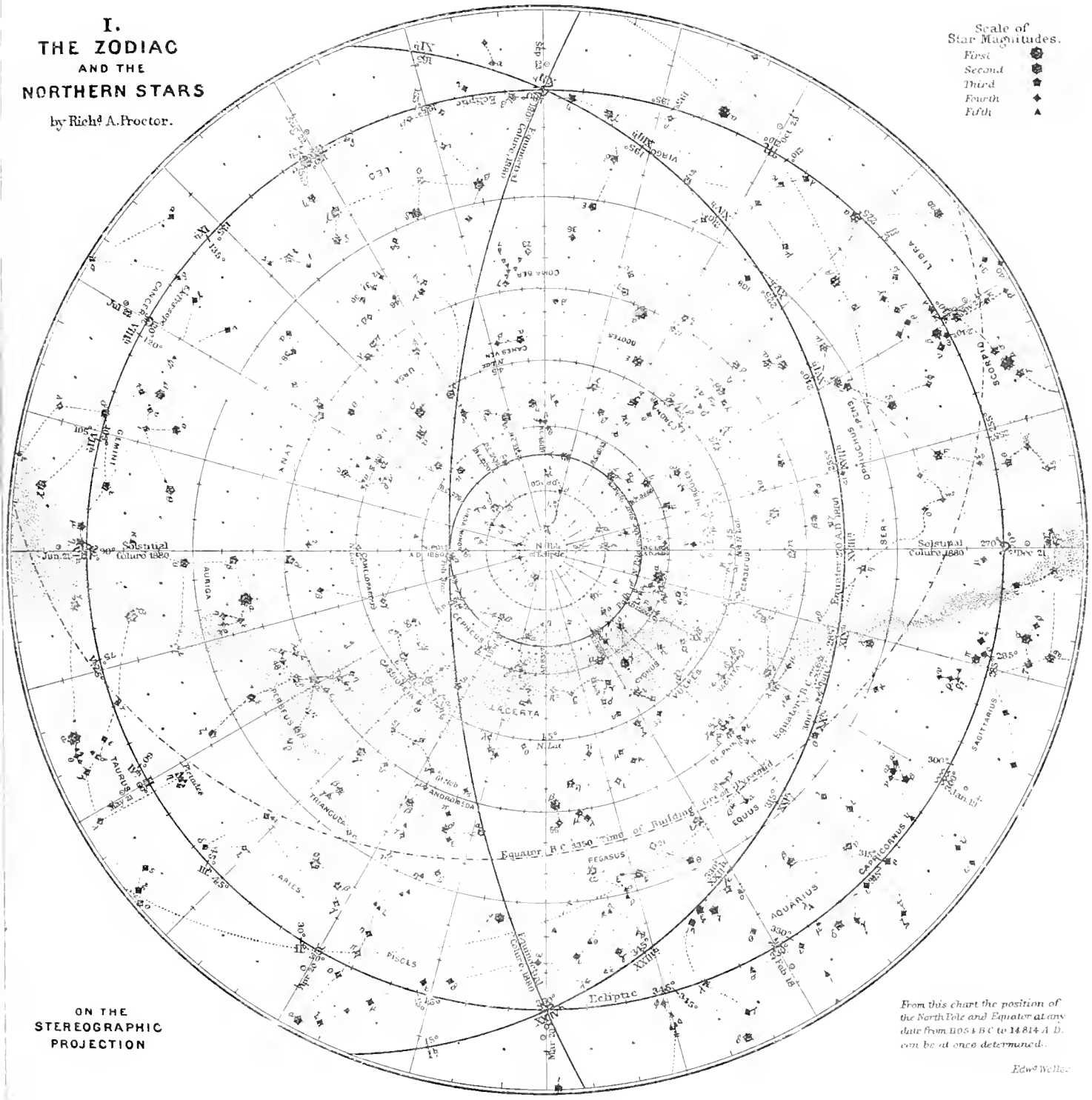
The map being on the stereographic projection, it is a very simple matter to mark in the equator (and colures if needed) for any given epoch. Thus, suppose the epoch to be 276 B.C., or 2156 years before the date of the map (1880). The precession of the equinoxes in 2156 years (one-twelfth of 25,868 years, the precessional period) amounts to 30° (one-twelfth of 360°). Thus, as the precessional motion carries the crossing-point of the equator on the ecliptic to meet the sun, we must take a point 30° in advance of the present crossing-point (♈), or to the first point marked ♑ in the map. This and the opposite point on the ecliptic, marked ♍, are the crossing-points of the equator on the ecliptic in the year 276 B.C. Then on the longitude circle through ♎ (that is, the radial line in the map to the point on the ecliptic midway between the two just determined), we measure off $23\frac{1}{2}°$ towards the pole of the ecliptic—that is, towards the centre of the map. A circle swept through the point thus determined and the two crossing points determined before, shows the position of the equator in the year 276 B.C. This circle is shown by a dotted arc in the accompanying map. The corresponding position of the north pole of the heavens at that time is shown on the circle indicating the path of the pole, 30° in longitude from the present position of the pole. The nearest visible star is the 5th magnitude star 4 Ursæ Minoris. (The stars 4, 5, β and γ of the Little Bear, doubtless formed the true Dog's Tail—γ marking the tip of the tail—not, as is commonly said, the stars now forming the constellation Ursa Minor, a group which can in no sense be likened to a dog's tail, whereas the group of four stars very well might. This Dog's Tail was the veritable polar-star group of the time of Hipparchus; and the name Kunosoura, or Dog-tail, served well to indicate the pole of the heavens, though perhaps few who use its modern form, Cynosure, and speak of a centre of attraction as "the cynosure of every eye," are aware of the real meaning and origin of the expression.

In the map there is also shown the position of the equator in the time of the building of the Great Pyramid, some 3350 years before the Christian era. (The positions of the pole in 3350 B.C. and 2170 B.C., equi-distant, as the map shows, from α Draconis, serve to explain why for awhile the later date was accepted as that of the building of the Great Pyramid. But now there can be no doubt that the earlier date is the true one; for Egyptology and the astronomy of the Great Pyramid are brought by this date into agreement, whereas the date 2170 B.C. is wholly inconsistent with the Egyptian records by which the dates limiting the dynasty of Cheops, Chephren, and the rest, have been indicated.)

The position of the equator as thus assigned for the time

I.
THE ZODIAC AND THE NORTHERN STARS

by Richd A. Proctor.



ON THE STEREOGRAPHIC PROJECTION

From this chart the position of the North Pole and Equator at any date from 1105 B.C. to 14,814 A.D. can be at once determined.

Edwd Wells.

of the pyramid builders is important as apparently indicating the aspect of the heavens at a time not very far from that at which the most ancient of the constellations received the names they still retain. This point, and other matters, will be considered later, as well as the simple methods by which a series of maps (for any date and latitude)—corresponding to the maps of "The Stars in their Seasons" for England and the present time—can be readily constructed.

(*To be continued.*)

OLD AND NEW ASTRONOMY.

AN AUTOBIOGRAPHICAL SKETCH.

TO explain the origin and purpose of "Old and New Astronomy"—a treatise which has been nearly a quarter of a century in preparation—one or two personal matters have to be touched upon, but I shall pass lightly over such details.

In October 1864 I was led to enter on scientific study by a domestic sorrow on which I had been brooding too deeply for my health. I selected astronomy as the subject which had greatest attractions for me, and, after reading afresh certain treatises, including Herschel's "Outlines of Astronomy," I sought for more detailed accounts of problems which appeared to me full of interest. Disappointed in this search, I began the preparation of the first of a series of monographs which I proposed to produce, in each of which an astronomical subject of special interest was to be carefully studied. I proposed in these works to deal with considerations which seemed to require fuller discussion than they had hitherto received, except in scattered papers, technical and unduly elaborate in character, so as to be calculated rather to load the back shelves of the libraries of learned societies than to instruct the world. In this way, and as yet by no means appreciating either the extent of the work I was attempting, or exactly what was fittest for my purpose, I wrote my treatise "Saturn and its System." I proposed to follow this up with similar treatises on Jupiter and Mars (of Mercury, Venus, Uranus, and Neptune, we know too little for monographic work), the sun, the moon, comets and meteors, the stars, star clusters, and nebulæ.

When "Saturn" had been published, I was led to defer my general plan for a while, in order to prepare a series of star charts (my "Gnomonic Star Atlas"), suggested during the preparation of that work; and in preparing the atlas I collected the materials for my "Handbook of the Stars." I had already begun, however, a monograph on Mars, when, in May 1866, a stroke of fortune deprived me of the means which had enabled me to carry on the work I had begun without any anxiety respecting the commercial success of the several volumes required for its completion. I had become too much attached to the work to be willing to turn wholly from it; yet it seemed as though other duties would force me to do so. Most occupations by which I could hope to support my family would have debarred me from all chance of continuing my work effectively. I determined that I would not seek for such employment in what is sometimes (I can scarcely imagine why) called "professional astronomy"—as, for instance, work in Government observatories or in collegiate teaching—as some appear to have found compatible with independent research and the work of scientific exposition. I was satisfied that I could do no good work in that way in the line I wished to follow, even if I had deemed it honest to accept a salary for doing one kind of work while devoting my main energies to another. Neither observatory work nor college teaching tend effectively to widen one's views of the great problems of astronomy; while too often it is found that official position, whether among the rank and file or in command, tends to warp both mind and character, and to diminish mental elasticity, versatility, and originality. I had already recognised the signs of this so clearly in treatises coming from such sources that I decided to retain the independence of my position, even though at the cost of some personal inconvenience.

After a year or two of interruption in my work, and considerable anxiety about other matters, I found what I sought in scientific literature, to which later I added scientific lecturing. I was able to turn my scientific notebooks to useful account by employing their contents as the materials for scientific exposition, finding that the general public needed only clearness and simplicity of expression, and the avoidance of unnecessary technicalities, to accept scientific teaching as they accept history, fiction, and kindred literary matter. Moreover, in the work of popular exposition I obtained unexpected help in my scientific researches. I found that the endeavour to present the results of scientific reasoning clearly and cogently affords a severe test of their accuracy. Often I have had to modify and more than once to abandon a theory, which, until exposed to this test, had appeared sound in all its parts. Even in lecturing I have recognised this quality in the task of explanation; while repeatedly also new ideas outside the theories I had already formed on specific subjects have been suggested during the actual progress of a lecture, for digestion and assimilation (if approved) at later leisure. Moreover, my lighter scientific treatises, essays, and lectures, have often brought me into correspondence with other students of science having facts of interest to communicate, or thoughts of value to suggest.

Thus, then, the two lines of work I had undertaken were continued together, each progressing at first slowly, but afterwards more effectively, until I had overcome the initial difficulties (which some had told me must necessarily be overwhelming), and had little further anxiety about either portion of my work. I was for a time interrupted, indeed, by the effects of a mistake I made in entering for a time on work connected with the Royal Astronomical Society, a body vexed with many turmoils, from whose perturbing influences I had trouble in withdrawing myself. I had, however, the satisfaction of knowing that I had fallen into this annoyance in the pursuance of a scientific duty, the correction of certain errors into which the chief official astronomer of that time (Sir G. B. Airy) had fallen respecting the transits of Venus in 1874 and 1882. I am not sure that apart from the improvement of the Government schemes for observing both transits which resulted from the inquiry, my labours were not fully repaid by the attention I was then able to direct to the fact, too commonly overlooked, that official scientists are the servants of the public (which includes scientific volunteers), and not set in authority over them. I was simply correcting inferior work of the chief of our paid astronomical servants—usually, it must be admitted (nay, I have always proclaimed) one of the hardest-working and most trustworthy of our Government astronomers.

But while I was able at once to maintain those whom it was my duty to maintain, and to continue my scientific work, I was not able to continue the production of the proposed series of monographs. A monograph on Mars, offered in turn to three leading publishing firms, was rejected by all of them. A large atlas on a new plan, since successfully carried out, was declined not only by publishers, but by the Astronomical Society. My "Other Worlds than Ours," in which I presented a brief abstract of my views on astronomy, had to appear under the guise of a popular

treatise to gain acceptance. Luckily, under this guise, the book was commercially successful.* The "Sun" was only in appearance a resumption of my original plan. Even as it was, the work was not sufficiently popular, and many passages in the first edition which had been most carefully written had to be removed from later additions, as too difficult for the general reader. The "Moon" was nearer the mark, at least as regards the first half of the first edition. But here again the reading public showed that they must not be invited to anything like arduous study, or even to any prolonged effort of reasoning. The best parts of the work had to be excised from the later editions. My "Geometry of Cycloids," and the books in which I discussed the Transits of Venus, were naturally regarded as still less suitable for the general public, though simple enough, I had thought, for all readers.

But while the plan for producing separate treatises had to be given up, I continued to keep in view the general work in which I had proposed to present in popular form a summary of the results presented in fuller detail in those monographs. "Old and New Astronomy" is the treatise thus planned as far back as in 1864, though it need hardly be said that the original plan has been largely modified during its subsequent development. The plan of this general work has been indicated elsewhere. So far as I know, no work of the same scope is in existence.

ROYAL VICTORIA HALL.

(*To the Editor of* KNOWLEDGE.)

ON the 14th inst. an exceedingly interesting lecture was given by Mr. Wethered on "Volcanoes and Earthquakes." It is difficult to give an abstract of a lecture which depended so much on the great beauty and interest of the slides shown. One set of these were taken by a San Francisco photographer during the recent eruption in Hawaii, and sent over by H.M.'s Consul in San Francisco specially for this lecture. They were taken at intervals of five minutes, and showed the progress of the lava. The first showed the molten stream just slipping over a cliff into the lake below. In the next the heated mass falling into the water had already begun to generate clouds of steam. Before long these obliged the photographer to shift his position, and the series ended with a photograph taken some time later, when the lava (which had entirely filled up the little lake before mentioned) was cool enough in places to walk on, and a scene of more entire desolation could not be imagined. Other views were taken in the crater of Mauna Loa, others again in the Bay of Naples; while a very interesting set showed the scene of the fearful eruption in New Zealand, including a portrait of the old chief who a few days before predicted an awful calamity. This he did because he was vexed at being refused a loan by a neighbour, but he did not believe in his own prediction sufficiently to run away, and he was killed by the eruption. Passing on to earthquakes, the lecturer said eruptions were always preceded by earthquakes, but their causes were not certainly known. In Japan a very delicate apparatus is in use for recording the shocks. A very slight jerk sets up an electric current by which one clock is stopped (recording the precise second of the shock), while other clockwork is set in motion by which paper is drawn across the point of a pencil. Thus the varying regularity and direction of the dots and strokes on the paper indicate the force and direction of the shocks. So delicate is this apparatus that it shows not merely actual shocks, but so-called "earth tremors," which seem to be due to the action of the wind on the earth. One theory of earthquakes attributes them to the shrinking of the earth's crust as it cools, which causes sufficient pressure to liquefy some of the rocks in the interior. As they liquefy they expand, and shake the earth above them in their efforts to make room or find a vent. Another theory is that water, penetrating through cracks to the hot interior, is changed into steam, and produces the same effect. Professor Milne's opinion is that earthquakes are the result of both causes combined, and his opinion is of weight, since he has for years been studying earthquakes under the most favourable circumstances in Japan, where they have an average of two daily!

The lecture concluded with a set of very interesting photographs, taken in Charlestown just after the earthquake there. In these the apparently capricious action of the destructive force was very striking. One house might be reduced to utter ruins, while the next was almost untouched.

The chairman (the Hon. and Rev. Canon Pelham) proposed a vote of thanks, which was very heartily responded to.

The lectures in prospect are—February 28, Mr. E. Hodder on Lord Shaftesbury; March 6, Dr. R. D. Roberts on "Nature's Sculpturing Tools"; March 13, Professor Sylvanus Thompson, "Electric Bells"; March 20, Dr. A. Wynter Blyth, "Food and its Adulterations"; March 27, Dr. Litton Forbes, "The Great Ice Age."

C. A. MARTINEAU.

1 Clifton Place, Sussex Square, W.C.

IN THE BEGINNING.*

SO long as human vanity, fed and supplemented by man's ignorance of the nature of his surroundings in the cosmos, prompted him to believe that our tiny world was the end, centre, and cynosure of all creation; that the sun, moon, and stars and all the host of heaven were called into existence solely for his benefit and guidance, and even in some sort that they might influence and reveal his destiny; in short, that the entire visible universe was brought forth by the fiat of Omnipotence for his behoof, and for that alone; just so long was he content to accept such legends and myths as that which appears, in two totally separate forms, in the opening chapters of Genesis as an actual historical account of the origin of the earth with its living wonders, the sky, and the infinity of suns and worlds of the macrocosm. The first blow (albeit, in the then existing state of knowledge it was but a feeble one) inflicted on this belief was by the putting forth by Copernicus of that theory of the solar system which placed the sun in its centre, and converted the hitherto suppositious heart of the universe into an insignificant member of a number of bodies revolving round that mighty source of light and heat. And, necessarily as

* Except Sir John Herschel and Mr. Herbert Spencer in England, Gérigny in France, and Oscar Peschel in Germany, few recognised the real purport of that work, which critics agreed in discussing from the point of view of those who take interest in the scarcely scientific problem of life in other worlds. Peschel recognised the chapters on the stars as deliberately challenging the accuracy of the Herschelian theory of the stellar universe, and, after an exhaustive analysis, decided that that theory was shown to be absolutely untenable.

* "The Story of Creation: a Plain Account of Evolution." By EDWARD CLODD. (London: Longmans, Green & Co. 1888.)

astronomical knowledge advanced, and it was found that while a persistent and unintermittent journey to the then outermost known boundary of the solar system pursued at the rate of fifty miles an hour would occupy 1,800 years (it would take 6,125 years to travel to the last-discovered planet Neptune at the same rate!), and when it was further realised that our entire system was but an impalpable mote of dust in the immensity of space, then, and not till then, did men begin to question that story of the world they dwelt on which had so long satisfied them. And, treading closely on the heels of the astronomer, came the geologist, who showed irrefragably, from the mere thickness and superposition of the strata of the earth's crust, that æons of ages must have been required for the deposition and consolidation of those rocks, which it had been aforetime believed were the werk of a day or two, some 5,000 years or so previously. Furthermore, from the rocks, thus interpreted, did the palæontologist extract the remains of a series of plants and animals ranging back to an antiquity so hoary as to baffle our finite conception and merely appal us; and then the comparative anatomist and physiologist showed the affinity of these extinct types with those existing, and pointed out how a certain continuity of plan had persisted from the dawn of life, so far as it was traceable. But this was all. Maillet, Buffon, and Lamarck all advocated, with increasing clearness, the theory of development and variation, having its origin in the surroundings of animal and vegetable life; a theory revived by Dr. Robert Chambers in the days of our fathers, in his now but unfrequently read "Vestiges of Creation;" but dawning popular enlightenment on this question was opposed and crushed by the dead weight of theological ignorance, intolerance, and actively exerted authority, and, up to within the last twenty or thirty years, the special creation and absolute immutability of every plant and animal was a creed, to doubt which was to be *anathema maran-atha*. The lion, the horse, the cat, the ape, and *à fortiori*, man himself, was each held to be the lineal descendant of an identical prototype, which appeared by the fiat of the Almighty much after the fashion of the egg which becomes visible in the fingers of the conjurer, who an instant before has invited his audience to "perceive that he has nothing in his hand!" The wonderful revolution in thought which has occurred in our own day with reference to the history of creation may be said to have had its inception—as pointed out by Mr. Clodd in the delightful volume now before us—in the sailing of that Newton among naturalists, Charles Darwin, from Plymouth in H.M.S. *Beagle*, on December 27, 1831. Upon the observations made during that voyage was founded that imperishable theory, subsequently elaborated by continuous research, and embodied in the year 1859 in a book that will survive as long as the language in which it is written—we mean of course "The Origin of Species"—in which the ground was at once and for ever cut from under the feet of those who insisted that species were the visible results of primordial acts of special creation. Yet farther. Physicists, of whom Laplace may for our present purpose be held to have been the first, have traced back our earth and its congeners from the time when the geologist shows it to us superficially solidified, but still calid with internal heat, to a period when it formed part of a stupendous mass of mere glowing mist or vapour; while at the other end of the scale psychologists and moral philosophers, among whom Herbert Spencer is *facile princeps*, have applied the doctrine of development to ethics, and shown how the very foundations of morality and religion are enshrined in the words, "For all the law is fulfilled in one word, even in this: Thou shalt love thy neighbour as thyself." Now, works exist in which cosmical physics are more or less popularly treated of. Such noble volumes as those of Lyell and Geikie enable the student to trace the history of the earth from the first formation of a continuous hard envelope on its surface down to the present instant. To say nothing of Darwin's own immortal "Origin of Species," writers like Romanes in "The Scientific Evidence of Organic Evolution," and Oscar Schmidt in his "Descent and Darwinism," have done much to popularise the theory of natural selection; while Herbert Spencer himself, the late Professor Clifford, the editor of this magazine, Miss Naden, and others, have equally succeeded in familiarising us with the essential principles underlying all real ethics. It has, however, been reserved for Mr. Clodd, in his latest work, to unite these seemingly discrete branches of the subject into one harmonious whole, and to tell sequently the story of the evolution of the visible universe, from its inception in a mass or masses of glowing vapour to the completion of the cosmos, as we know it, in all its appalling complexity. And surely this astounding history has never been told more popularly, perspicuously, and pleasantly than in the volume before us. In the very outset its author defines Force and Energy in terms which cannot but be helpful to the but too often puzzled student of dynamics, and gives an elementary exposition of the nature of matter which contains the pith of many more pretentious treatises. Then, after a rapid sketch of the earth as a planet, he proceeds to trace her past life history, and to tell the story of the appearance and development of organised beings upon her surface—from the awfully remote date of the first traces of fucoid and foraminiferal forms, through the mollusca, the strange and weird types of crustacea, fish and reptiles, the giant mammalia, the ape, the cave-man, and so to Shakespeare, Newton, and Darwin himself. This is followed by a dissertation on present Life-forms, in which embryology is invoked to show how each being in the course of its development from the ovum passes through all the stages which in its progenitors formed the final and permanent life-forms, and hence supplies, as it were, a pictorial history of its origin, or series of ancestral portraits. In all this the unity of Nature is most strikingly brought out. In the second part of his work our author treats of the mode of becoming and growth of the universe, and shows how it had its origin in the co-existence of matter and power. He then descants, in a most lucid style, on the origin of life and life-forms. In equally perspicuous fashion does he discuss the origin of species, explaining and enforcing the doctrine of its immortal discoverer. And this part of his work we would earnestly commend to those who conceive that they reply to the Darwinian argument by demanding to be shown the missing links between existing types and their progenitors. Cavillers of this kind may learn here how very shallow their objections really are. The volume concludes with an account of social evolution, including under that head the evolution of ethics and theology, of which part of Mr. Clodd's work it must suffice to say here that it will come as a revelation to a very large number of persons who are—or believe themselves to be—extremely religious. To any who have ever read Mr. Clodd's delightful "Childhood of Religions," or, in fact, who have acquaintance with any of his writings at all, it must seem almost an impertinence to insist on the charm of his style. Assuredly that charm is conspicuous enough in the work now before us. The volume is well and abundantly illustrated, but in connection with the frontispiece we must caution the non-astronomical reader that the wood-block has been turned on its side, and that to view its delineation of the wonderful nebula surrounding θ Orionis, as it is actually seen in the telescope, the engraving should be viewed with the title-page beneath it.

EVOLUTION OF LANGUAGE.

By Ada S. Ballin.

IX.—DEMONSTRATIVE AND PRONOMINAL ROOTS.

PROFESSOR MAX MÜLLER has distinguished two kinds of roots—the *predicative*, denoting either existences or actions, and the *demonstrative*, marking positions or localities of existences or actions. Thus, taking as a concrete example the root *eat*, which simply expresses an action, and the roots *here*, *there*, *yonder*, expressive of positions in which an action may take place, we can, using them in a Chinese fashion, get the sentences: Eating here = I eat; eating there = thou eatest: eating yonder = he eats, which would be expressed in gesture language by imitating the movements of mastication and pointing to oneself for "I eat," to one's interlocutor for "thou eatest," and to the person referred to for "he eats," or, in the case of the absence of that person, by making the sign used to represent him.

I have discussed as exhaustively as space permitted the first class of these roots described in a former article*—namely, those signifying action or quality, whence by far the greater number of words is derived—and I have shown the probable origin of these "units of speech." It is now time to consider the second and less important class, composed of roots which signify position. There are not more than a dozen of these roots, and some of them were probably derived from one original. From this class come the interrogatives, roots generally containing *k*, the demonstratives, containing *t* or *n*, the personal pronouns, possessives and relatives, with the adverbs of position and direction. It is very noticeable that suchlike words are not confined to any one family of languages.

It has been suggested, as Whitney says, not without some degree of plausibility, that the pronominal roots in Indo-European and other languages have a sort of physical *raison d'être*. *Ma*, our *me*, is produced by closed lips, as if shutting out the rest of the world, while the demonstrative *ta*, our *that*, is produced by the thrusting forward of the tongue in the mouth, as if to point at the object signified; and the same suggestion may be made with regard to Semitic pronouns, as *ani*, Hebrew and Arabic, "I"; *atta* or *ant*, "thou," which, as a final enclitic, becomes *ta*; *asher* or Arabic *hatha*, "that"; also Arabic *thalik*.

On some such theory may perhaps be explained the resemblance of Aryan and Semitic pronouns, as, for example, Hebrew *hoo*, Arabic *hooa*, "he"; Hebrew *hame* (pronounced like "lame"), Arabic *humma*, "them."

Our primitive fathers, like children and savages, did not distinguish between object and subject. The accusative of the first person historically preceded the nominative; hence *ma*, *mi* are attached to the first person of the verb, not *ego*, *aham*. The Sanskrit *aham*, according to Benfey, grew out of an older form, *maham*. The nominative plural in Lith. is *mes*, in O. Prus. *mes*, in O. Slav. *my*, in Ossetic *mach*, in Lapp *mi*, in Pali *mayam*, and in Greek and Latin there are the verbal endings *men* and *mus*, as in *tuptomen*, *scribimus*. The change of *m* into *v* is by no means rare. A gentleman from German Switzerland told the late Professor Key that where he lived all the people said *mir* sagen in preference to *wir* sagen; and in the Lithuanian the nominative and accusative *ve-du* and *mu-du* coexist. The Sanskrit plural nominative is *vayam*, formerly doubtless *mayam*, as in Pali. The Zend is *vaêm*, and the Gothic *veis*. The interchange of the liquids *m* and *n* is very common. In Sanscrit in the oblique cases of the dual and plural, we find *nâu* and *nas*, in the Zend dual *nô* and *ne*, Greek dual *νῶϊ*, Latin plural nominative *nos*. Although the Lapp language is not supposed to belong to the Indo-European family, its pronouns closely resemble them. Thus, according to Fiellström†:—

The Nom. is	*mon*, I	*tudn*, thou	*soden*, he
„ Gen. „	*mo*, of me	*to*, of thee	*sa*, of him

From *parne*, son, comes *parnam*, my son; from *nipe*, knife, *nipnt*, thy knife; from *aija*, grandfather, *aijabs*, his grandfather. In a related language, Teheremissian, we find‡:—

atu-m,	my father	*ischtene-m*,	I do
atu-t,	thy „	*ischtene-t*,	thou doest
atu-sha,	his „	*ischtene-she*,	he does
atu-na,	our „	*ischtene-ne*,	we do
atu-da,	your „	*ischtene-da*,	you do
atu-sht,	their „	*ischtene-sht*,	they do

Rask§ gives the Lapp pronouns as follows:—

Nom.	*mon*, I	*don*, thou	*son*, he
Pl.	*mi*, we	*di*, ye	*si*, they
Gen.	*mò*, of me	*dú*, of thee	*sú*, of him

Vhael gives the Finn pronouns as:—

Nom.	*minä*, I	*sinä* or *tämä*, thou	*hän* or *se*, he
Pl.	*me*, we	*te*, ye or you	*he*, they
Gen.	*minun*, mine	*tunin*, thine	*hänen*, his

Out of a list of ninety negro languages, in more than seventy the pronouns of the first person consist of *ma*, *man*, *me*, *mi*, *mu*, *nu*, *ne*, *ni*, *iu*, or *m* and *n* as a prefix, and *m*, *n*, or *ng* is used in a similar way in Asia, Siberia, and America.

The plural of the first personal pronoun is naturally an extension of the singular, and whether we find it with an *n*, a *w*, or a *v*, we can easily trace its original form to the radical consonant *m*, with its idea of inwardness or subjectivity. Similarly with the second person in forms with *d*, *th*, *dh*, or *z*, we trace the original *t*—the thrusting forward of the tongue as in pointing to a person or object; and hence we find a close relationship existing between the second personal pronoun and the demonstrative. The Sanscrit neuter nominative *tat* = this. *This*, *that* in Arabic is *dha* and *dhu*; Hebrew, *zeh*. The Slavonic languages have demonstrative pronouns beginning with *t*, like the Greek τὸ, τοῦ: in Mongol *ere* this corresponds to *tere*, that, like our *here* and *there*, and *ouba* and *touba* = this and that. The Lapp demonstrative is *daat* or *dat*. The Sanscrit relative and interrogative is *ku-s*, with the *dhâtŭ*, *kinn*, Ionic κοῦ, κῇ, κότερος: *quehat* and *quichere* = our *what* and *where*. Our *which* is from a former *whilk*. In Portuguese we find *quem sabe?* "who knows?" Spanish *quien sabe?* Sardinian *chini*, interrogative and relative: Turkish *kîm* or *kim*, with a variety *kih*; while the Finnish has *cu-ca* (Lat. *quisque*) and *ken-kä* as interrogatives, *cuin* as a relative, and *cu-mpsi* as the equivalent of the Latin *uter* (formerly *cuter*). Old Slav. has the forms *chso* or *cheso* for interrogation, and Mongolian *ken?* who, which. One form of the interrogative in Lapp is *gi*, "who?" gen. *geen*, "whose?" *g* superseding the Finnish *k*. In Chinese interrogative adverbs the *k* sound predominates—*kĭ-tō*, "how much?" *kĭ-tá*, "how great?" *kĭ shĭ*, "at what time?" "when?" *siĕn-kĭ-niên*, "how many years ago?" *kĭ* at the beginning of a sentence is interrogative (*quomodo*), and in Chinese literature *kó*, *hô*, and *yĕn* are used as interrogatives. The striking resemblances of distinct families of speech with regard to

* Vol. ix. p. 286.

† Gram., p. 32.
‡ *Ibid.*, pp. 20, 21.
§ Rask's Gr., p. 79.
‖ P. 41.

the interrogative *k* would lead us to assume a physical reason for its use; but with regard to this I can only hazard a conjecture that just as the voice is raised in interrogation, so the tip of the tongue thrust forward for the demonstrative dental *t* rises in sympathy with the voice for the palatal *k* of interrogation. *T'* and *k*, it will be remembered, are frequently interchanged. With regard to the affirmative particle I hardly dare even venture a guess; but I would suggest that when, in the gesture of affirmation—the forward nod—the teeth are closed, the expulsion of the air through them which sometimes takes place in the sudden nod would give rise to a hissing sound *s* or *shi*, while if the mouth is partially opened an *i* or *yi* sound would result. Some such cause must be at the root of the resemblances in the affirmative particle which we find in so many languages of different families. For example, it is noteworthy that *shí*, *jên*, and *yiù* express acquiescence "yes" in Chinese, and may be compared, at any rate as far as sound goes, with our *yes*; German *ja*. In Arabic *iy* answers to our *yes* or *yea* when followed by an oath.

Although the origin of the affirmative particle is not satisfactorily discovered, that of the negative is quite clear. When the infant is not hungry, or does not wish to take anything into its mouth, it moves its head from side to side to avoid the object offered, at the same time closing its lips tightly, and when the voice is exerted through the closed lips the sound *m* or *n* is given out.* This accounts for the widespread use of these sounds to express the negative, as in the Greek *mê*, Latin *ne*, whence *nego*, French *nier*, Illyrian *nekati*, On. *neita*, *nita*, to say *ne*, "deny, refuse." It will be remembered that the expression of the negative is usually accompanied by a lateral shake of the head.

The simplest form of the negative in Latin and Teutonic languages is *ne*, whence *non* from *ne-unum*, old form *nenu*, in the same way as our *none* from *ne one* or *no one*, German *nein* from *ne-ein*, and later English *no*. From it the Romans got the compounds *ne-quis*, *ne-uter* (*neuter*), *n'ullus*, the substantive *ne-mon-*, German, *nie-mand*, the adverbs *n'unquam*, *n'usquam*, and the verbs *ne-queo*, *ne-scio*, *ne-uolo*, afterwards *nolo*. In Anglo-Saxon we have *nis*, "is not," *nás*, "was not," *ic nát*, "I wot not," *ic nah*, "I own not," with *ic nah*, "I own;" *ic nabbe*, "I have not," *ic nelle*, "I will not," with a perfect *nolde*, similar to our expression *willy-nilly*, "whether he will or no." Jamieson gives the old Scotch *nam*, "am not," *nar*, "were not," *nat*, "wot not," as well as *nold*. The very word *not* itself is a similar compound of Gothic *ni-raiht*, Anglo-Saxon *nawiht*, German *nicht*, and our *naught*. Chaucer says, "They knew him *naught*." Old Scotch has *noct*, R. Brunne *noght*, and Robert of Gloucester *nogt*. Lat. *non* is reduplicative, and has a stronger sense than *ne*, as in the repetitive French expressions *ne . . . pas*, *ne . . . point*, *ne . . . rien*. *Mu* is one of the forms of the negative in Semitic languages; in Hebrew it is used as an interrogative, and in Arabic as the negative of the definite or absolute present, and of the perfect *not*. In Arabic there is also an interrogative form, *amā* (used in the same way as the Latin *nonne*), with dialectic varieties, *ama*, *hamā*, *hama*, &c.; in Hebrew there is also a form with the interrogative *he*, followed by *im*. Another form of the negative is *la* in Arabic, *lō* and *al* in Hebrew, probably a derivative from the older *m* form. Both are combined in the Arabic *lam*, negative of the perfect *lamma*, "not yet"; Heb. *lamma*, "why?"

In oaths the Hebrew *im* is a negative particle, but it commonly means *if*. Probably the original meaning of *im* was "is it not?" *Ain* in Hebrew = *no*thing, or *not*; as in *ain lee*, I have not, is also used in an interrogative sense, "where," Arab. *ayin*. Indeed, in most languages the negative readily passes into the interrogative, as, "Is it not so?" In Chinese the negative adverbs are: *mŭ*, "to be without"=*no* or *not*, the opposite of *yiŭ*, "to have"="yes there is"; *pŭ*, *not*, the most common negative, which has no other use; *fi*, "not to be—false," it is not opposed to *shí*, "to be"="yes it is"; *wû*, "not to have"="without"=*mŭ-yiŭ*, also much used (the Canton dialect expresses the negative of possession by *mò*); *mŏ*, "not, do not," a synonym of *pŭ*, "not," and *m* in the Canton dialect, which is the equivalent of the *mŏ* and *pŭ* of the books.

Here *pŭ* and *fi* have doubtless their origin in the *pooh*, *faugh* sound with which we reject a nauseous morsel, and similarly an unpleasant proposition, while the *w* in *wû* is most likely the phonetic representative of the earlier form with *m*. With regard to the interrogative use of the negative as in Aryan and Semitic languages, in Chinese *mò* is a final interrogative in the Mandarin, and *nī* in the Canton dialect. In Chinese, as in several other languages, two negatives make an affirmative: thus, *mŏ-fī*, in *ngŏ mŏ-fī shwo-hwang pŭ ch'îng*, "I surely do not lie at all," and *wû-fī*, and *fī* with *pŭ* are similarly used, as *fī t'ā pŭ k'ò*, "cannot do without him." *Wû* is sometimes used as a prohibitive "Do not!" and so also is *mŏ* when it stands alone.

* See "Thought and Language," x, KNOWLEDGE, vol. vii., pp. 474-475.

Reviews.

Astronomy for Amateurs. Edited by JOHN A. WESTWOOD OLIVER. With the Assistance of T. W. BACKHOUSE, F.R.A.S.; S. W. BURNHAM, M.A., F.R.A.S.; J. RAND CAPRON, F.R.A.S.; W. F. DENNING, F.R.A.S.; T. GWYN ELGER, F.R.A.S.; W. S. FRANKS, F.R.A.S.; J. E. GORE, M.R.I.A., F.R.A.S.; Sir HOWARD GRUBB, F.R.S., F.R.A.S.; E. W. MAUNDER, F.R.A.S.; and others. (London: Longmans, Green, & Co. 1888.)—Mr. Westwood Oliver and his very able staff of coadjutors have produced a work of enduring value to the astronomical student in the volume before us, of which it is not too much to say that it should be carefully studied by every incipient observer who hopes or wishes to do any work whatever of scientific value. For it is especially with such work, as contradistinguished from mere desultory stargazing, that this capital little book concerns itself; and, no matter to what special branch of astronomy the beginner proposes to devote his energies, he will here find explicit directions, from a master hand, for the most successful method of prosecuting his studies, and enriching science by the results of his personal labour. After a preliminary discourse on the leading divisions of astronomical research by the editor, we have a thoroughly practical chapter on the telescope and observatory by Sir Howard Grubb. Then Mr. Maunder follows with an equally practical one on solar observation; while it is only necessary to mention Mr. Elger's name as the author of the chapter on the moon to indicate its value and excellence—a remark which we may equally extend to Mr. Denning's dissertations on the planets and on meteors. The last-named gentleman also contributes a chapter on comet-seeking. The subject of double stars is admirably treated by him who is *facile princeps* as their observer and discoverer—we mean, of course, Mr. S. W. Burnham; while equal justice is done to that of variable stars by Mr. Gore. Mr. Backhouse and Mr. Baird Gemmill treat jointly on stellar distribution; a chapter on the zodiacal light being founded on contributions by the gentleman first named and Mr. Arthur Searle. The work concludes with

a short account of the methods of observing the (questionably astronomical) phenomenon of the aurora by Mr. J. Rand Capron. We think that our mere *précis* of the contents of the volume whose title heads this notice will practically suffice to justify the terms of commendation in which it commences. Certainly no more useful work to the beginner has yet appeared. A very careful perusal of it has failed to reveal more than three obvious errata. The first occurs on page 129, where it is alleged that "the solar parallax . . . is now adopted at 8·78," which is certainly not the case. The parallax adopted in this country is 8·848″, while the Belgian results make it greater still. At the time we write the American ones have not been made public. Perhaps the author was thinking of Dr. Gill's Mauritius results, which are—Dr. Gill's and nobody else's; and of which he himself says ("Dunecht Observatory Publications," vol. ii. p. 212), "We do not attach very much importance to the value of the parallax deduced." The second mistake appears on page 130, where it is alleged of Venus, in and close to inferior conjunction, that "the interior region of the disc is seen perceptibly lighter than the dark background of the sky on which it is projected." Practical observers of repute have seen it *darker* than the light background of the sky on numerous occasions, so that the statement as it stands is far too unqualified. The third error we have noted is in the engraving of the "Aurora theodolite" on page 314, where that instrument is represented with an object-glass which has, in reality, no existence.

Capital: a Critical Analysis of Capitalist Production. By KARL MARX. Translated by SAMUEL MOORE and EDWARD AVELING, and edited by FREDERICK ENGELS. (London: Swan Sonnenschein, Lowrey & Co. 1887.)—The common-sense reader, unfamiliar with the rudiments of political economy, will rise from the perusal of this combination of virulent declamation and pseudo-scientific exposition with a feeling akin to that experienced by the incipient logician when he makes his first acquaintance with the old puzzle of Achilles and the Tortoise. He will find a good deal that appears to him at first sight inexpugnable in the shape of sequent argument; but underlying which he feels intuitively there is some stupendous fallacy. It is only upon re-reading Herr Marx's two volumes that he will thoroughly realise how the dominant motive of their author is an almost insane class-hatred: and how, in his endeavour to gratify it, he is absolutely indifferent whether he is dealing with fact or fiction. An extract taken absolutely at random will illustrate this. It is one that strikes our eye as we write, and occurs in the form of a footnote on page 250, which begins thus, "In England even now occasionally in rural districts a labourer is condemned to imprisonment for desecrating the Sabbath, by working in his front garden." If Herr Marx does not know this to be absolutely false, his translators and editor do, and the mere retention of such an allegation in its pages shows the animus with which the work is written. It is quite true that, on rare occasions, that pest the "common informer," has summoned a tradesman under the very discreditable, but practically obsolete, Act 29 Car. II., c. 7, for doing "work of his ordinary calling upon the Lord's Day," and has obtained a conviction; but this is a very different thing to that alleged by the author of the work before us. A labourer working in his own front garden is not "following his ordinary calling," and the statute does not apply to him in any way. The whole book is one sustained tirade against the middle-class capitalist. The mere sight of the word "bourgeois," or the idea of the social condition it implies, appears to exercise an influence on Herr Marx compared with which that of a red rag on a bull may be regarded as sedative and tranquillising. The perusal of a work like this to any one who has studied such masterly and scholarly expositions of economic science as those of Mr. Dunning McLeod, is like reading an essay by a boy in the Fourth Standard at a Board School, by anyone familiar with the undying work of Addison and Steele.

Manual of the Sextant. By CHARLES W. THOMPSON, F.R.G.S. (London: John Bumpus, 1887.)—Mr. Thompson's excellent manual of the sextant may be confidently recommended to all travellers and explorers whose outfit of instruments is confined to the one of which it treats, together with an artificial horizon and a chronometer. The optical principles on which its action depends are clearly explained, and this explanation is followed by a detailed description of the construction and use of the sextant as at present framed by our leading makers. Then the beginner is instructed how to use the instrument in observing altitudes and angular distances, and the methods of employing it to determine latitude, time, longitude, and the variation of the compass, and to set out a meridian line, are taught in a manner so simple, that no moderately attentive reader can possibly fail to thoroughly grasp the modes of obtaining the results sought. Wisely eschewing formulæ, our author works out numerical examples of the various processes at full length: and, at the end of his book, furnishes all the tables necessary for the reduction of the observations made. When Mr. Thompson's volume runs into its inevitable second edition, we should recommend him to obtain and describe one of the remarkably ingenious prismatic sextants made by Pistor and Martins, the opticians in Berlin. These instruments measure angles up to 180°. And we may add in conclusion, the expression of our surprise that in a book in other respects so complete, no mention whatever is made of the method of determining the excentricity of the sextant—a matter of vital importance, if it is to be employed for refined work.

The Brassfounder's Manual. By WALTER GRAHAM. Seventh Edition. (London: Crosby Lockwood. & Son, 1887.)—When a book on a purely technical subject has run into its seventh edition, it may fairly be assumed to have criticised itself, and to have established its own claim to excellence. Assuredly in the present case the success achieved has been well deserved, for a more complete little manual than Mr. Graham's we have rarely come across. Invaluable to the commercial brassfounder, it will be found replete with information of use to the amateur who tries his hand at the construction or repair of optical and other scientific instruments. The workman who buys this little volume may further derive very great benefit, outside and beyond that of a merely technical character, by the careful perusal of pages 20 and 21.

The Eskimo Tribes. By Dr. HENRY RINK. (Williams & Norgate.)—The principal object of the present work, the eleventh of a series on Danish investigations in Greenland, published at the cost of the State, and which its learned author has made more accessible by an English version, is to furnish an idea of the elements of the little-known Eskimo language. But for us the main interest lies in the earlier chapters, which discuss the mode of life, dwellings, religious and social arrangements of the Eskimo tribes, and especially in the first chapter, in which Dr. Rink, while expressing no decided opinion, collates the evidence which tends to confirm the theory that they migrated from the interior of Alaska, dispersing northwards until their final settlement in Labrador and Greenland. The subject is of importance as a contribution to the movements of races in prehistoric times, and to the general question of man's origin in, and migration from, northerly hemispheres. As our readers

may remember, Professor Boyd Dawkins inclines to the theory that the Eskimo are the descendants of the men of the reindeer period, who retreated in a north-westerly direction, a theory based upon certain physical similarities and upon like customs. But this short notice is not the place for its discussion, and, moreover, we hope to return to the subject at a future time. Students of folk-lore and traditions are familiar with Dr. Rink's volume of Eskimo tales, and he has placed them further in his debt by the publication of the present treatise.

Tenants of an Old Farm: Leaves from the Note-book of a Naturalist. By Henry McCook, D.D. With an Introduction by Sir John Lubbock. (Hodder & Stoughton.)—No compliment is paid to science by dressing up its facts in the guise of fiction, and the wonders of insects, especially ant-life, which are the subjects of this book, stand least of all in need of the story-teller's artifice to enhance interest in truths which are "stranger than fiction." As Dr. McCook has, however, with some hesitation as he tells us, chosen to season natural history with romantic admixture, we must be thankful that the work has fallen into hands as competent as his. The book is written in an attractive and animated style, and is amply illustrated with accurate, and often fantastic, woodcuts.

Our Whist Column.

By "Five of Clubs."

A SAMPLE OF LAST CENTURY'S WHIST.

THE *Australasian* publishes an interesting illustration of the whist of a century ago. It remarks that "in 1871 Mr. Hugh Lennon presented to the Melbourne Public Library a poem in heroic metre which was published anonymously in London in 1791. This bears the title of "Whist, a Poem in Twelve Cantos." The author "thought proper to assume the character of a vain, petulant stripling, whose opinion of his own wit and abilities is so overweening that he thinks they entitle him to fall foul of everything that comes in his way." In his poem he not only embodies the accepted canons of the long whist of a century ago, but also discusses the requisites of a good player. Of these he signifies three in particular:—(1) Memory, (2) judgment, (3) temper. To the tenth canto he prefixes the following argument:—"Temper, the third requisite at whist. Three causes of loss of temper. (1) Bad luck, (2) cross play, (3) a bad partner. Cards a terrible trial for the temper. Story of Smilinda and her lover Pusillo." This story is in brief that "Pusillo" was very much in love with "Smilinda." Being a very cautious "bird," however, he thought it best to make "one nice experiment" before demanding the lady's hand, whereby

> He might the certain knowledge gain,
> If she her temper could at cards retain.

The opportunity presents itself when Pusillo and Smilinda are partners at whist against "cousin Booby's son, a country squire," and "Aunt Rebecca." Pusillo begins by making some deliberate mistakes which are of no great consequence. Smilinda is fuming inwardly, but her eyes continue "to retain their placid charm." At length, in a close struggle for an all-important odd trick, Pusillo commits a gross blunder, and throws away the game. Thereupon

> The gentle creature could endure no more,
> She started up, she stamped, she raged, she swore,
> Proclaimed her wrongs, and threw the cards away,
> Nor longer in his presence deigned to stay.
> . . . . . .
> And thus that flame, which had for years endured,
> In one short minute was entirely cured.

In the text the author describes the play of the hand in a general way; in an appendix he gives in detail the cards which fall to the several successive tricks. The result is the earliest example of an "illustrative whist hand" with which we are acquainted. Moreover, the hand is fairly well played throughout, except just at the point where Pusillo deliberately throws away the chance of winning the odd trick."

THE HANDS.

B { D. (*trumps*).—8, 5. H.—A, Q, 7. / C.—Q, 7, 5. S.—A, Kn, 10, 9, 6. }

Y { D. (*tps*).—K, 6, 4. C.—A, Kn, 10, 3. H.—K, 9, 8, 6. S.—8, 1. }

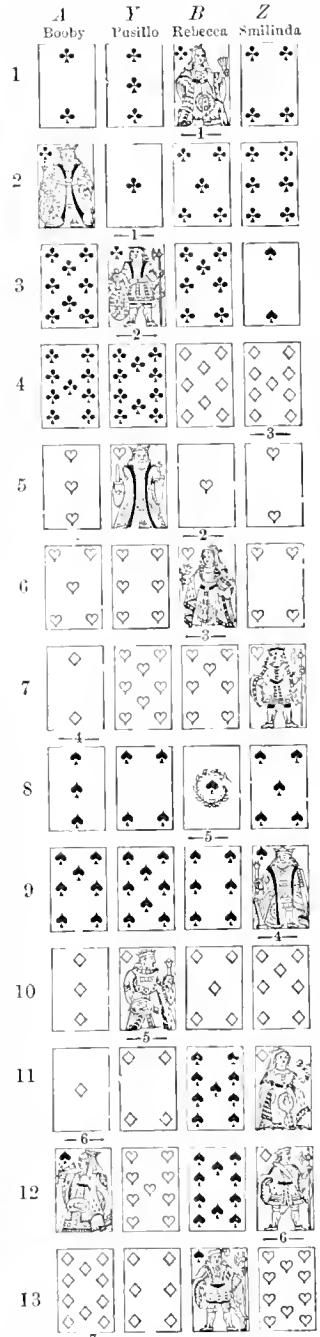
B / Y Z / Tr. D. 9 / A leads.

Z { D.(*tps*). -Q, Kn, 9, 7. C.—6, 4. H.—Kn, 10, 4, 2. S.—K, 5, 2. }

A { D. (*trumps*).—A, 10, 3, 2. H.—5, 3. / C.—K, 9, 8, 2. S.—Q, 7, 3. }

Score (apparently):—Booby and Rebecca, nine; Pusillo and Smilinda, seven.

Card underlined wins trick; card underneath leads next.



And Booby and Rebecca win the odd trick against two by honours.

NOTES ON THE PLAY.

Trick 1.—Booby leads correctly from his numerically strong suit.

Trick 2.—But in preference to returning the club Rebecca ought to have led either her spade ace or her diamond eight. Also, if the club was to be returned at all, the seven ought to have led, not the five.

Trick 3.—Smilinda properly discards the spade two.

Trick 5.—Smilinda—

> "Now with careful eye her hand surveys,
> And from the knave a heart unwilling plays;
> A vile, unlucky lead in every view—
> (And yet what better could the virgin do?
> Her king of spades but once defended lay,
> And could not to the ace be left a prey;
> Her trumps, the last resort, were now too few,
> Since one from four her former triumph drew).
> A vile, unlucky lead; for full command
> Lay couched in ambush in Rebecca's hand."

Trick 6—

> "And now Rebecca's queen a trick to gain
> Had sanguine hopes; nor did she hope in vain.
> The lead should ne'er be changed without a cause,
> So from her hand another heart she draws."

Trick 7.—Of course Smilinda ought to have played the heart ten.

Trick 10—

> "But now the nymph no longer would delay,
> Though rather weak, her suit of trumps to play."

Trick 11.—Here, again, Smilinda plays the higher, instead of the lower, of two sequence cards.

Trick 12.—Pusillo makes a gross blunder—

> "(For) had he so inclined, his chance was sure,
> This trick to conquer, and the game secure;
> . . . . .
> But thoughts of different hue his mind engross;
> His am'rous heart contemns the rubber's loss;
> With wilful error slips the trump to play,
> And throws at one rash stroke their all away."

Our Chess Column.

By "Mephisto."

THE following game will be found interesting, as it records a somewhat novel defence to the Bishop's Gambit. It has always been our belief that the play in this interesting opening has been far from exhausted, either for the attack or the defence.

One of fourteen games played simultaneously by Captain Mackenzie against Mr. J. D. Seguin — a strong player — at New Orleans, January 23, 1888 :—

Bishop's Gambit.

White. Mackenzie.	Black. Seguin.	White. Mackenzie.	Black. Seguin.
1. P to K4	P to K4	13. P to Q5	B × QKt
2. P to KB4	P × P	14. P × B	P × QP
3. B to B4	P to Q4	15. P × QP	Kt to B3
4. B × P	Q to R5 (ch)	16. P to B1	QR to Ksq (*g*)
5. K to Bsq	P to QB3 (*a*)	17. Q to Q3	Kt to K5 ! (*h*)
6. B to B4 (*b*)	B to KKt5	18. B to Kt2 (*i*)	Kt to Kt6 (ch)
7. KKt to B3 (*c*)	Q to R4	19. K to B2	R to K6 !
8. P to Q4	P to KKt4	20. Q to Q4	Kt × R (ch)
9. Kt to B3	Kt to Q2	21. R × Kt	P to B3 (*j*)
10. P to KR4 (*d*)	Castles	22. Q - P(B3) (*k*)	KR to K sq
11. Q to K2 (*e*)	Kt to Kt3	23. Kt to K5	Kt to Q2 ! (*l*)
12. B to Kt3	B to Kt2 (*f*)	24. Q × KtP	Kt × Kt

And Black won.

(*a*) The object of this move is to facilitate rapid castling on the Queen's side. We have seen many fine games played in this opening where this has been done. White will subsequently be compelled to play P to Q4 to develop his game, and prevent the Black KB harassing the White K by playing to B4. Under these conditions, Black by castling QR besides bringing his K into safety for a time, brings his Rook to Qsq, thereby establishing a kind of masked battery on the Queen, which the latter is usually compelled to avoid by moving on the King's file. Black will then direct his play on the Queen's Pawn, and, under certain circumstances—for instance, to be able to play R to Q8 (ch), and for other combinative purposes—Black may sacrifice a piece effectively. These are some features of the game if Black castles QR, but if he fails to do so, then P to B3 becomes a loss of time, as Black will probably have to play P to KKt4 to defend his KBP, which would give White two squares, namely Q6 and KB6, where he threatens to place his Queen's Knight, which often succeeds when the defence is indifferently conducted, resulting sometimes in the loss of the Black Queen; this is brought about by a series of moves whereof the following are the essential ones, namely QKt to B3, P to Q4, P to K5, Kt to K4, &c. Then, again, we have often observed that the Black P on B3 makes an ultimate advance of the White Q's P—if properly supported by the Kt on QB3—all the more effective, for if then Black takes, White, amongst other things which he might do, may retake with his Knight, which then would occupy a strong and menacing position on Q5; in the alternative of Black not taking the P on Q5, it leaves White the option of weakening Black's Q's side by playing P × P, or playing P to Q6, &c., if worth while. These are the main outlines of this attack, and it may be said that he who develops most rapidly will obtain an advantage; but whether the defence adopted in the text is good, experience alone must decide.

(*b*) We should prefer B to Kt3.

(*c*) Here it may be observed that Q to Ksq might come in useful, for if Black changes Queens, then—the fact of the White B on B4 threatening the Black KBP preventing Black for the moment from castling QR; the position of Black's Pawns on the King's side rendering an attack on them profitable; the superior position of White's Pawns on the Queen's side; the fact of the Black P on B3 preventing him from playing his QKt to B3—all these, in themselves very small items, would, combined, render White's game more desirable. If Black does not change Queens, then the move of the Queen will come into effect later on, after Black has castled QR, by avoiding the "masked battery."

(*d*) P to Q5 would not do now, because Black would reply with Kt to K4; but it will be seen (in illustration of our note *a*) that under circumstances (for instance when the White KKt is not doubly pinned, or the White B had retired to Kt3) this may be a strong move. In illustration of another point touched upon in our note *a*, 10. P to K5, with the intention of playing Kt to K4, is now also inadmissible, because then Black castles, threatening Kt - KP; and if White, in order to forestall this move, continues with 11. Q to K2 (to avoid the masked battery, the necessity of doing which we mentioned in note *c*), then Black, by playing Kt to Kt3, attacking the B (which, according to note *b*, ought to have been played to Kt3), will win the QP.

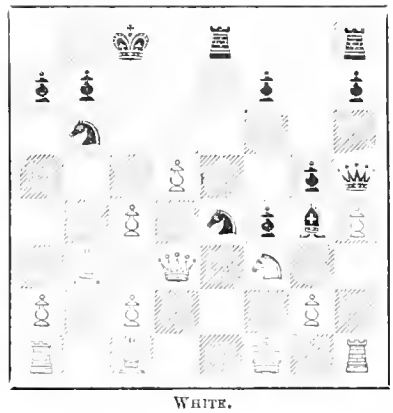
(*e*) The *Times Democrat*, New Orleans, here points out that if White plays 11. K to Ktsq instead, then Black has at his disposal the ingenious continuation B to Kt2, for if then 12. P × P, B × Kt ! and Black would win the QP with a good game.

(*f*) If Black plays R - P, White would reply 13. Q to B2, compelling the Rook to move, after which 15. Kt - P would gain some advantage.

(*g*) Why not the King's Rook ?

(*h*) Black has developed his pieces rapidly and with precision. The advance of the QP has, under the circumstances, turned out dangerous for White. Black has now a winning game.

Black.



White.

(*i*) It would be but a very poor expedient to try and avoid the loss of the exchange: for instance, by 18. K to Ktsq, Kt to Kt6; 19. R to R2, B - Kt; 20. P × B (best, for if 20. Q - B, Black mates in two moves); 21. R to K8 (ch) and wins.

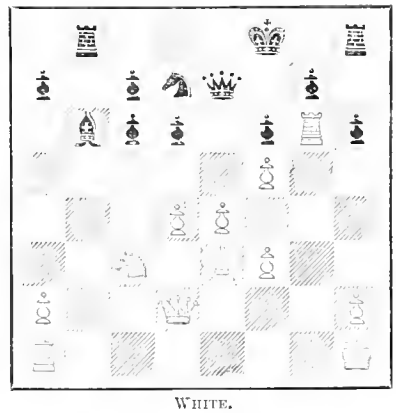
(*j*) Under the circumstances this move does no harm.

(*k*) We should have preferred to utilise the time given by Black's last move to play 22. Q to B4 (ch), K to Ktsq; 23. Kt to Q4.

(*l*) A winning move. White cannot take the Kt on account of mate threatened by R to B7 (ch), &c.

Position after Black's 20th move in a game, being one of sixteen games played simultaneously by Captain Mackenzie at New Orleans on January 25 :—

J. G. Blanchard.
Black.



White.
Mackenzie.

The game continued :—

21. QR to KKtsq	R to K2
22. B - P !	

Fine play, and apparently quite sound.

22.	P - B

If R - B, White would have the ingenious reply of 23. Q × R, as the P could not retake, for that would be mate in two moves. But now White misses a chance of speedily determining the game. Instead of 23 Q × P (ch) he ought to have played 23. R to Kt8 (ch), K to B2 then 24. Q × P would win a Rook, as Black has no better reply to this threatening move than R × R.

23. Q - P (ch.) !	K to Ksq
24. R to Kt8 (ch)	Kt to Bsq
25. R - Kt (ch)	

All this is highly interesting play; if now Q × R White plays Q × R—

25.		K to Q2
26. Q - R		

This move is now forced—

26.		Q × Q
27. R × R		K to K2

Thus Black misses a chance by not playing the obvious move of B - P. If, then, 28. R (Ktsq) to Kt8, Black plays P to B4, and there is no danger. Black subsequently missed some further chances of playing for a draw, and the game concluded in the following curious way:

White.	Black.	White.	Black.
28. Kt to K2	P to B4 ?	41. R to K4 (ch)	K to Q8
29. Kt to B4 !	P to Q4	42. R to Ktsq(ch)	K to Q7
30. Kt × P (ch)	K to Q3	43. R(Q4) to KKt4	P to B5
31. Kt - KBP	Q to R6	44. Kt to K4 (ch)	K to Q6
32. P to K5 (ch)	K to B3	45. R to Qsq (ch)	K to B7
33. P to Q5 (ch)	K to Kt4	46. R to Q2 (ch)	K to B8
34. R to Ktsq (ch)	K to B5 ?	47. P to KR3 !	Q - P ?
35. R to Kt8	Q × BP (ch)	48. R to K2	P to B6 !
36. R to Kt2	Q - BP	49. R (Kt4) to Kt2!	K to Q8
37. R to KKt4(ch)	K to Q6	50. Kt to B2 (ch) !	B × Kt
38. R to QKt3(ch)	K to B7	51. R - Q	P to B7
39. R to B4 (ch)	K to Q8	52. B - B	Resigns
40. R to KKt3	K to K7		

THE FACE OF THE SKY FOR MARCH.

By F.R.A.S.

SPOTS appear at very infrequent intervals on the sun's disc, but watch should always be kept for them whenever an opportunity offers. At 4 o'clock in the early morning of March 20 the sun is said in the almanacs to "enter Aries." Reference to plate xvi. of "The Seasons Pictured" will show that he is at this instant in the Constellation Pisces. Spring begins, and this is the theoretical date of the Equinox, which actually happens in London a day or two sooner. The Zodiacal light is now visible on every clear evening over that part of the horizon beneath which the sun has set. The night sky is depicted in map iii of "The Stars in their Seasons." Minima of Algol ("The Stars in their Seasons," map xii.) occur 1 minute after midnight on the 3rd; at 8h. 50m. P.M. on the 6th; at 1h. 14m. A.M. on the 24th; at 10h. 33m. P.M. on the 26th; and at 7h. 21m. P.M. on the 29th; and at other hours inconvenient to the observer. After the first two or three days Mercury becomes a morning star, but is not in a good position. He attains his greatest elongation west of the sun (27° 47') at 1 o'clock in the morning of the 31st, but at this date he rises but a very little before the sun. Venus is a morning star too, and is but poorly placed for observation and wonderfully shorn of her glory. Mars may be seen by midnight in Virgo ("The Stars in their Seasons," map v.); a very moderate telescope will now show detail on his surface. Jupiter will scarcely be fairly visible until next month. He is situated about twelve diameters of the sun or moon to the NW. of Antares ("The Stars in their Seasons," map vii.). Saturn may be seen all night long, and is, as ever, an all repaying object in the telescope. He lies to the west of the Præsepe in Cancer ("The Stars in their Seasons," map iii.). Uranus may be very fairly well seen before midnight now, and will be found not far from θ Virginis ("The Stars in their Seasons," map v.), somewhat to the south and west of that star. With a sufficiently high power his planetary disc at once distinguishes him from the surrounding stars. Neptune is rather less than 6° south of the Pleiades ("The Stars in their Seasons," map i.), but he is getting rapidly into the sun's rays now. The moon enters her last quarter at 3h. 26·1m. A.M. on the 5th, and is new at 4h. 21m. in the afternoon of the 12th. She enters her first quarter at 8h. 43·4m. P.M. on the 20th, and is full at 10h. 7·4m. on the night of the 27th. Six occultations of stars by the moon will occur at fairly convenient hours during the present month. Before she rises on the 3rd she will have occulted 49 Libræ, a star of the 5½th magnitude with her bright limb. Later on it may be seen to reappear at her dark limb half-an-hour after midnight at an angle of 274° from her vertex. On the 18th B.A.C. 1351 of the 6½th magnitude will disappear at the dark limb at 6h. 42m. P.M. at a vertical angle of 162°: reappearing at the bright limb at 7h. 49m. P.M. at an angle of 287° from the moon's vertex. On the 20th χ^3 Orionis, a 6th magnitude star, will disappear at the dark limb at 5h. 11m. P.M. at an angle of 70° from the vertex of the moon. Its reappearance at the bright limb happens at 6h. 32m. P.M. at a vertical angle of 297°. On the 20th 68 Orionis, a 6th magnitude star, disappears at the moon's dark limb at 10h. 21m. P.M. at an angle of 136° from her vertex: to reappear at her bright limb at 11h. 25m. P.M. at a vertical angle of 302°. On the 22nd B.A.C. 2683, of the 6th magnitude, disappears at the dark limb 23m. after midnight at a vertical angle of 154°. It will reappear at 1h. 13m. the next morning at the bright limb of the moon at an angle of 264° from her vertex. Lastly, on the 28th, yet another 6th magnitude star, 80 Virginis, will disappear at 7h. 49m. P.M. at the moon's bright limb, at an angle from her vertex of 10°. Its reappearance at the dark limb will happen at 8h. 43m. P.M. at a vertical angle of 230°. We exclude the occultation of η Libræ on the 31st, as disappearance does not happen until between 1h. and 2h. A.M., which hour extends beyond those within which we limit the prediction of these phenomena in this column. When these notes begin the moon is in Virgo, which constellation she quits for Libra at 9h. 30m. A.M. on the 2nd ("The Seasons Pictured," plate xxxii.). Having traversed Libra, she arrives at 2h. A.M. on the 4th at the western edge of the narrow northern spike of Scorpio, across which she has passed by 11 o'clock the same morning and entered Ophiuchus. She remains in Ophiuchus until 1h. 30m. A.M. on the 6th, when she enters Sagittarius. Her journey through the last-named constellation finishes at 10h. A.M. on the 8th, when she quits it for Capricornus ("The Seasons Pictured," plate xxi), through which she is travelling until 10h. 30m. A.M. on the 10th. Then she crosses into Aquarius, her passage over that constellation occupying until noon on the 12th, at which hour she leaves Aquarius for Pisces ("The Seasons Pictured," plate xxii.). In the course of her journey through Pisces, she arrives at 9h. A.M. on the 13th on the confines of Cetus, through which she travels until 5h. P.M. on the 14th, when she comes out again into Pisces, only, however, to re-enter Cetus at 5h. P.M. on the 15th. When finally she quits Cetus, 30m. after noon on the 16th, it is to emerge in Aries ("The Seasons Pictured," plate xxiii.). Just 24 hours later, *i.e.* at 0h. 30m. P.M. on the 17th, she leaves Aries for Taurus. In the course of her journey through Taurus, she arrives at noon on the 20th on the western edge of the northernmost prolongation of Orion. By midnight she has crossed this and emerged in Gemini. At 9h. P.M. on the 22nd, she leaves Gemini for Cancer ("The Seasons Pictured," plate xxiv.), as she does Cancer in turn for Leo at 9h. 30m. A.M. on the 24th. Her passage through Leo finishes at 9h. P.M. on the 26th, at which hour she quits it for Virgo ("The Seasons Pictured," plate xxv). She is travelling through Virgo until 7h. P.M. on the 29th, when she once more leaves that constellation for Libra ("The Seasons Pictured," plate xxvi.). Journeying over Libra, as at the beginning of the month, she arrives at the northern spike of Scorpio at 9h. 30m A.M. on the 30th, her passage through which is complete by 6h. 30m. P.M., when she comes out in Ophiuchus. She is still in Ophiuchus at midnight on the 31st.

Strange Form of Hydrophobia.—A few weeks ago Frank Tribbey, jun., a married son of Frank Tribbey, sen., proprietor of the Occidental Hotel, New Albany, Ind, was taken with a mysterious malady that baffled the skill of the physicians. He had every symptom of hydrophobia, and was so violent that the physicians were compelled to strap him down in bed. The physicians finally pronounced the case spinal meningitis. Tribbey after several days recovered, and was about the street until last evening. During last night he was again seized with a recurrence of the same symptoms. He barked like a dog, and became so violent that his friends were compelled to strap him down. Tribbey is said to be in a critical condition. Eight years ago he was bitten by a dog. It may be that some virus was left in the system from the bite.—*Cincinnati Inquirer.*

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THE KINSHIP OF MEN AND APES, ETC.

By Professor E. S. Morse.*

ONLY the briefest reference can here be made to a few of the numerous contributions on the subject of man's relation to the animals below him. The rapidly-accumulating proofs of the close relation existing between man and the quadrumana, make interesting every fact, however trivial, in regard to the structure and habits of the higher apes.

Dr. Arthur E. Brown† has made some interesting experiments with the monkeys at the Zoological Gardens in Philadelphia. He found that the monkeys showed great fear, as well as curiosity, when a snake was placed in their cage, though they were not affected by other animals, such as an alligator and turtle. On the other hand, mammals belonging to other orders showed no fear or curiosity at a snake. These experiments, repeated in various ways, lead him only to one logical conclusion, "that the fear of the serpent became instinctive in some far-distant progenitor of man, by reason of his long exposure to danger and death in a horrible form, from the bite, and that it has been handed down through the diverging lines of descent which find their expression to-day in Homo and Pithecus" [*i.e.* Man and Ape].

The same author,‡ in an exceedingly interesting description of the higher apes, says: "Mr. A. R. Wallace once called attention to the similarity in colour existing between the orang and chimpanzee and the human natives of their respective countries. It would, indeed, seem as if but half the truth had been told, and that the comparison might be carried also into the region of mind: the quick, vivacious chimpanzee partaking of the mercurial disposition of negro races, while the apathetic, slow orang would pass for a disciple of the sullen fatalism of the Malay." [The resemblance between the gorilla and the negro is even more striking in some respects than that between the latter and the chimpanzee. I dwelt on this in an article on "The Gorilla and other Apes," in my "Pleasant Ways in Science," pp. 302, 303.—R. P.]

Dr. Brown§ has also given a description of the grief manifested by a chimpanzee on the death of its mate. His grief was shown by tearing his hair or snatching at the short hair on his head. The yell of rage was followed by a cry the keeper had never heard before, a sound which might be represented by *hah-ah-ah-ah-ah* uttered somewhat under the breath, and with a plaintive sound like a moan.

Mr. W. F. Hornaday* read at the Saratoga meeting of this Association an exceedingly interesting paper on the "Habits of the Orang," as observed by him in his native forests. He says, "Each individual of the Borneo orangs differs from his fellows, and has as many facial peculiarities belonging to himself alone, as can be found in the individuals of any unmixed race of human beings." After recounting the many traits of the orang, heretofore regarded as peculiar to man, he says: "Let any one, who is prejudiced against Darwinian views, go to the forests of Borneo. Let him there watch from day to day this strangely human form in all its various phases of existence. Let him see it climb, walk, build its nest, eat and drink and fight like human 'roughs.' Let him see the female suckle her young and carry it astride her hip precisely as do the coolie women of Hindoostan. Let him witness their human-like emotions of affection, satisfaction, pain, and childish rage—let him see all this, and then he may feel how much more potent has been the lesson than all he has read in pages of abstract ratiocination.

Professor W. S. Barnard several years ago, in a study of the myology [or muscle-work] of man and apes, showed that the scansorius muscle which Traill studied in the higher apes and which he supposed had no homologue in man, was really homologous with the *glutæus minimus* in man. Dr. Henry C. Chapman,† in a study of the structure of the orang outang, has confirmed the truth of Barnard's discovery. Dr. Chapman is led to infer that the ancestral form of man was intermediate in character, as compared with living anthropoids or lower monkeys, agreeing with them in some respects and differing from them in others. [This view is discussed in an article on "Our Ape Cousins," in a recent volume of Knowledge.—R. P.]

The osteological affinities which man has with the *Lemuridæ*, as insisted upon by Mivart, are also recognised by Cope.‡ In a general paper on the "Origin of Man and other Vertebrates," he says: "An especial point of interest in the phylogeny [or tribe origin—but oh! these wordmongers!] of man has been brought to light in our North American beds. There are some things in the structure of man and his nearest relatives, the chimpanzee, orang, &c., that leads us to suspect that they had rather come from some extinct type of lemurs."

It would seem as if we must look farther back than the higher apes for the converging lines of a man's relations with them. The earliest remains of man or the apes found fossil, presenting as they do marked types with little tendency to approach one another, would in themselves suggest an earlier origin for both stocks. [And that earlier origin must share descent with contemporary races from an earlier origin still; and that, &c.—R. P.]

In a paper by Professor Cope§ on "Lemurine Reversion in Human Dentition," he says, in concluding his article: "It may be stated that the tritubercular superior molars of man constitute a reversion to the dentition of the *Lemuridæ* of the Eocene period of the family *Anaptomorphidæ*, and second, that this reversion is principally seen among Esquimaux and the Slavic, French, and American branches of the European race."

In another paper by the same author on the "Developmental Significance of Human Physiognomy," he compares the proportions of the body and the facial peculiarities of man with the higher apes and human infants, and shows that

* From an article on American Zoologists and Evolution, in the "Popular Science Monthly." (New York.)
† "American Naturalist," vol. xii., p. 225.
‡ Ibid., vol. xvii., p. 119.
§ Ibid., vol. xiii., p. 173.

* "American Naturalist," vol. xiii., p. 712.
† "Proceedings of the Philadelphia Academy of Natural Sciences," 1880, p. 163.
‡ "Popular Science Monthly," vol. xxvii., p. 609.
§ "American Naturalist," vol. xx., p. 941.
‖ Ibid., vol. xvii., p. 618.

the Indo-European, on the whole, stands higher than the other races in the acceleration of those parts by which the body is maintained in an erect position, and in the want of prominence of the jaws and cheek-bones, which are associated with a greater predominance of the cerebral part of the skull and consequently greater intellectual power.

Dr. Harrison Allen,* in a study of the shape of the hind-limb as modified by the weight of the trunk, dwells on the manner of articulation in the gorilla of the fibula with both calcaneum and the astragalus, as well as the fact that the astragalus in that genus possessed a broad, deflected fibula facet, and says: "This peculiar projection is rudimental in the astragalus of civilised man, but was found highly developed in an astragalus from an Indian grave found at Cooper's Point, New Jersey."

In my Buffalo address, I alluded to a paper by Professor N. S. Shaler on the intense selective action which must have taken place in the shape and character of the pelvis in man on his assumption of the erect posture—the caudal vertebræ turning inward, the lower portion of the pelvis drawing together to hold the viscera, which had before rested on the elastic abdominal walls, the attending difficulty of parturition, &c. Dr. S. V. Clevenger† has since called attention to other inconveniences resulting from man's escape from his quadrumanous ancestors. In a paper entitled "Disadvantages of the Upright Position," he dwells particularly on the valves in the veins to assist the return of blood to the heart, which, considered from the usual teleological point of view seems right enough; but why, he asks, should man have valves in the intercostal veins? He shows that in a recumbent position these valves are an actual detriment to the flow of blood: "An apparent anomaly exists in the absence of valves from parts where they are most needed, such as the venæ cavæ, spinal, iliac, hæmorrhoidal, and portal. The azygos veins have important valves. Place man upon 'all-fours,' and the law governing the presence and absence of valves is at once apparent, applicable, so far as I have been able to ascertain, to all quadrupedal and quadrumanous animals. Dorsad veins are valved; cephalad, ventrad, and caudad veins have no valves." By means of two simple diagrams he shows clearly the distribution of valved and unvalved veins as they exist in mammals, and why in man the same arrangement becomes detrimental. He dwells on the number of lives that are sacrificed every year by the absence of valves in the hæmorrhoidal veins. He also mentions other disadvantages in the upright attitude, as seen in the position of the femoral artery, even with man's ability to protect it. Its exposed condition is a dangerous element. Inguinal hernia, of rare occurrence in mammals, occurs very often in man, at least 20 per cent. being affected. Strangulated hernia also causes many deaths. Prolapsus uteri and other troubles and diseases are referred to by Dr. Clevenger as due to the upright position. In other words, the penalties of original sin are in fact the penalties resulting from man's assumption of the erect posture. [For an account of Dr. Clevenger's views, see article on "Upright Man" in my "Universe of Suns."—R. P.]

In another paper by the same author,‡ on the "Origin and Descent of the Human Brain," he gives an interesting sketch of the phylogenesis of the spinal cord to its ultimate culmination in the development of the brain of man. He says that the most general interest centres in the large mass of cells and nerve-fibres called the cerebrum. "In the ornithorhynchus it is smooth and simple in form, but the beaver also has an unconvoluted brain, which shows at once the folly of attaching psychological importance to the number and intricacy of folds in animal brains. With phrenology, which finds bibativeness in the mastoid process of the temporal bone, and amativeness in the occipital ridge, the convolutional controversies must die out, as has the so-called science of palmistry, which reads one's fate and fortune in the skin-folds of the hand."

Professor Alexander Graham Bell* has presented a memoir to the National Academy on the "Formation of a Deaf Variety of the Human Race," in which he shows by tables a series of generations of certain families in which the progenitors being deaf-mutes this peculiarity becomes perpetuated in many of the descendants. Recognising fully the laws of heredity, natural selection, &c., he shows that the establishment of deaf-mute schools, in which a visual language is taught which the pupils alone understand, tends to bring them into close association with one another; and that naturally, with this seclusion, acquaintance ripens into friendship and love, and that statistics show that there is now in process of being built up a deaf variety of man.

Dr. W. K. Brooks,† animated by the cogency of Professor Bell's reasoning, is led to prepare an article, entitled "Can Man be Modified by Selection?" In this paper he discusses the startling proposition of Professor Bell, and recognises the convincing proof which he furnishes to show that the law of selection does place within our reach a powerful influence for the improvement of our race. The striking character of the tables of facts presented by Professor Bell, and the significant suggestions of Dr. Brooks, lead one to consider how far the influence of selection has had to do with the character of great communities, as to their intelligence or ignorance. When we see nations of the same great race-stock, one showing a high percentage of illiterates, a high death-rate, degradation and ignorance, while just across the borders another nation, apparently no better off so far as physical environments are concerned, with percentage of illiterates and death-rate low, intelligent and cleanly, we are led to inquire if here a strict scientific scrutiny with careful historical investigation will not reveal the cause of these conditions. Can it be proved beyond question that the illiteracy and degradation of Italy and Spain, up to within recent years at least, is the result of centuries of church oppression and the Inquisition, destroying at once or driving out of the land all independent thinkers, and at the same time forcing her priests to lead celibate lives and inducing others of cultivated and gentle minds to lead cloister lives? Is it also a fact, as Alphonse de Candolle asserts, that by far the greater number of distinguished scientists have come from Protestant pastors? He gives a significant list of eminent men whose fathers were Protestant pastors, saying that, had they been priests of another religion, leading celibate lives, these men would not have been born.

It is considered an intrusion into matters which do not concern science when such inquiries are made, but the scientist has very deeply at heart the intellectual and moral welfare of the community. If the cause of degradation and ignorance, of poverty, of contagious disease, or of any of the miseries which makes a nation wretched, can be pointed out by scientific methods, then it is the stern duty of Science to step in, and at least show the reasons, even if the remedy is not at once forthcoming. The men who would be reformers and agitators, and who by their earnestness and devotion get the attention of multitudes, are unfit for their work if they show their ignorance, as most of them do, of the doctrines of natural selection and derivation.

* "Proceedings of the Philadelphia Academy of Natural Sciences," 1885, p. 383.
† "American Naturalist," vol. xviii., p. 1.
‡ "American Naturalist," vol. xv., p. 513.

* "Memoirs of the National Academy of Science," vol. ii., fourth memoir.
† "Popular Science Monthly," vol xxvii, p. 15.

WEIGHING THE EARTH.

THE great difficulty in determining the earth's mass arises from the circumstance that it surpasses so enormously that of any known body with which we can compare it. A mountain may exert an attraction measurably comparable with that of the earth; but a mountain is not a known mass, for we are not able to examine the mountain's whole structure, and short of such examination the mountain's mass must remain doubtful. We may descend into mines and recognise a change in the force of gravity suggestive of the law or laws according to which the density of the earth's interior varies as the centre is approached; but we must always remain in doubt how far the change may be due to peculiarities in the structure of the strata through which the mine penetrates. The only trustworthy determinations of the earth's mass are those in which the attraction of some known mass of matter, as a globe of lead or platinum, is directly compared with that of the earth; and the largest masses of the kind which have yet been used in this way have been so infinitesimally small compared with the mass of the earth, that it is only by apparatus of extreme delicacy that any measurable alteration of terrestrial attraction has been produced: so that all experiments of the sort are affected by a certain degree of uncertainty, depending on the delicacy of the methods employed, and what may be called the tenuity of the results deduced.

It is a serious mistake to describe the measurements of the earth's mass made by Maskelyne on Mount Schehallien, and by Mr. Dunkin in the Hartley coal-mine, in terms implying that the precision of the processes employed involved a corresponding degree of accuracy in the results obtained. Nothing but the most precise and careful observation and experiment could have led to any observable, still less to any measurable results. But we must not suppose, because exceedingly delicate and precise observation can alone lead to any results at all in such experiments, that therefore results obtained by such observation are themselves of corresponding precision; on the contrary, the reverse must be assumed, unless the results obtained by different researches of this class shall be found to agree so closely as to indicate more trustworthiness in such methods than had been anticipated. But this has not happened. On the contrary, the reverse has thus far proved to be the case.

The Schehallien experiment, and experiments of the same type, may, with amply adequate precision, be thus described:—

Let M m, M′ m', fig. 1, be the slopes of a mountain such as Schehallien, suitably situate so that whatever attraction its mass may be capable of exerting can be estimated with fair chance of freedom from serious error; in other words, the mountain must stand in some degree apart, must admit of being thoroughly surveyed by geologists, and must present such features as suggest probable uniformity of interior stratification. Suppose now that B and B′ are two stations on a meridian—that is, on the same north-and-south line—whose positions have been determined by trigonometrical survey. Observations made at B and B′ with the zenith sector would indicate the true difference of latitude between B and B′, were the plumb-lines at B and B′ in the true vertical directions A B and A′ B′. But if the attraction of the mountain's mass draws these plumb-lines into the positions A b and A′ b', then the latitudes of B and B′ as determined by the zenith sector would be incorrect. Evidently, B being the northern station, and B P the direction of the polar axis, the plumb-line A b makes a smaller angle than A B, the true vertical, with the direction of the pole, or seems to indicate for B too high a latitude; while A′ b' makes a larger angle than A′ B′ with the polar axis, and seems to indicate for B′ too low a latitude. Both displacements increase the apparent difference of latitude; and comparing the difference of latitude determined by trigonometrical survey with the difference indicated by the plumb-lines at B and B′, the disturbing effect of the attraction of the mountain-mass is determined. Hence, after reductions and computations which, though seemingly complex, depend on established and even simple principles, the astronomer is able to compare the attraction of the earth with the attraction of the mountain, and if the mass of the mountain can be ascertained, the mass of the earth can be deduced.

FIG. 1.—The Schehallien Experiment for determining the Earth's Mass.

Bouguer and La Condamine, during experiments on Chimborazo, recognised the effect of the mountain's attraction in deflecting the plumb-line (by about 11″), but no estimate of the earth's mass was obtained, the conditions being too complex and uncertain. It was not till 1774 that a definite attempt was made to measure the earth's mass by this method. In that year Maskelyne made observations on the northern and southern slopes of Schehallien, a mountain only 3,000 feet in altitude, but well suited for the experiment. The sum of the deflections observed amounted to 11″·6; and from this result Messrs. Hutton & Playfair, after as thorough an examination of the mountain's structure as could be made, deduced for the earth's mass a value corresponding to a mean density exceeding that of water 4·713 times. Observations made in 1885 on Arthur's Seat by Colonel James, Superintendent of the Ordnance Survey, indicated a mean density of 5·316.

Another method depends on the diminution of attraction as we ascend above the earth's surface. The rate of oscillation of a pendulum will be calculably reduced at a height of two or three miles above the sea-level. If set at such a height on a mountain summit, the attraction of the mountain's mass will diminish the reduction of the rate of oscillation. Hence, if we know the mass of the mountain and measure the effect of its attraction, we can deduce the mass

of the earth.* From observations made on Mont Cenis by this plan, Plana and Carlini deduced a value of 4·950 for the earth's mean density.

The converse of this method has also been used. If the oscillations of a pendulum at the sea-level be compared with those of a pendulum at a great depth below that level (as in a deep mine), we can compare the mass of the whole earth with that of an outer shell limited by an imaginary spheroidal surface concentric with the surface of the earth, and passing through the underground station. For this shell, supposing it homogeneous, would exert no attraction at all at the lower station, and its non-homogeneity can be taken into account. The pendulum at the lower station is attracted only by the mass within the imagined spheroidal surface, with such corrections as may be due to the irregularities of the structure of the shell exterior to it, and more particularly to peculiarities in the neighbourhood of the mine where the experiment is tried. If the earth were of uniform density the attraction at the lower station would obviously be less than that at the outer, in the same degree that its distance from the centre is less; for masses of the complete sphere and of the sphere within the lower station are proportioned as the cubes of their radii, while gravity at the two stations would be as these masses directly and inversely as the squares of those radii; hence, considering both the masses and the distance, the attractions at the two stations would be inversely as the distances of these stations from the earth's centre. But if the earth's density increases towards the centre, the attraction at the lower station may be equal to or greater than that at the upper. Apart, then, from considerations depending on the configuration of the mine and the structure of the strata through which it has been dug,* the interpretation of the observed difference of

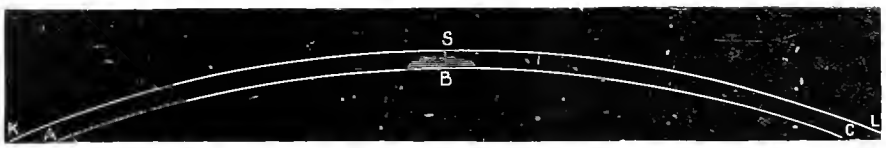


Fig. 2.—Illustrating the Mine Method of Weighing the Earth.

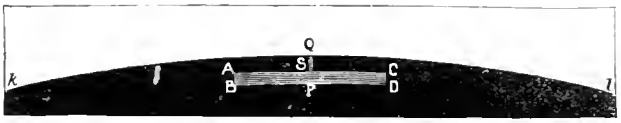


Fig. 3.—Illustrating the Determination of Gravity at the Bottom of a Mine.

* The time of oscillation of a pendulum of given length, l, is inversely proportional to $\sqrt{g}$, where g represents the force of gravity as measured by the velocity it can generate in a unit of time. Hence, if g, g' represent gravity at the sea-level and at height h above that level respectively, and t, t' are the respective periods of oscillation as calculated for stations so situated respectively (the attraction of the mountain itself being neglected), we should have, approximately,

$$t : t' :: \sqrt{g'} : \sqrt{g}$$
$$:: r : r + h$$

(r being the earth's radius). For, regarding the earth as a globe made up of concentric layers, each of uniform density, the earth's whole mass may be supposed at the centre, and gravity therefore inversely as the squares of the distances from the centre—that is, $g : g' :: (r+h)^2 : r^2$.

But if calculations based on the known configuration and structure of the mountain indicate that its mass would produce an attraction f on a body at its summit, and t'' be the observed time of oscillation at the mountain's summit,

$$t : t'' :: \sqrt{g'+f} : \sqrt{g}.$$

Thus, if the times of oscillation t and t'' be accurately compared, while t' is computed, we obtain the ratio of t' to t'', or $\sqrt{g'+f}$ to $\sqrt{g'}$; whence the ratio of f to g' and thence to g is obtained; and thus the mass of the earth may be compared directly with that of the mountain. Of course, though the principle of the method is thus indicated, the actual computations are by no means so simple.

* The effect of the removal of large quantities of material from below the surface is to *increase* the attraction on the pendulum at the bottom of the mine. It will suffice, in illustration of this, to consider the earth regarded as a homogeneous globe, and the space dug out as of some regular figure, as a cylinder. The student will readily infer (which is all I wish here to indicate) the nature of the general considerations which have to be taken into account in dealing with such problems:—

Let B, fig. 2, be a mine of any figure, with, however, a horizontal base. Take the spherical shell A S C, of which the inner surface coincides with the base of the mine. Then the attraction at the bottom of the mine is that due to the mass of the sphere within the shell, plus the attraction of the incomplete shell; and the incomplete shell attracts the particle towards the earth's centre with a force precisely equal to the repulsion due to a mass filling the space B. For if the attraction exerted by the incomplete shell be A, and that exerted by the portion B (supposed filled) be B, then we know that

$$A + B = 0$$

or

$$A = -B.$$

Hence, instead of considering the incomplete shell A, we need only consider the *repulsion* exerted by a mass filling B, every particle of which is to be supposed to repel with a force exactly equal to that with which it would in reality attract.

Let us suppose our mine to be cylindrical, fig. 3, representing a section through the axis and the shaft S coincident with the prolongation of the axis. A pendulum is swinging at Q and another at P in Q S produced. The shaft is supposed so narrow that we need not consider it, and, for convenience, we suppose its length equal to half the depth of the mine:—

Let r = earth's radius
$2a$ = mine's depth (Q P)
a = length of shaft (Q S)
b = radius of cylinder (B P)

Then the attraction at Q is equivalent to the attraction of a sphere of radius r, diminished by the attraction of the cylinder A D, that is (from the known value of the last-named attraction—

$$= \frac{4\pi\rho r}{3} - 2\pi\rho\left\{a - \sqrt{4a^2 + b^2} + \sqrt{a^2 + b^2}\right\}, \quad (\alpha)$$

(ρ being the density of the supposed homogeneous sphere).

Again, the attraction at P is equivalent to the attraction of a sphere of radius $r - 2a$, increased by the *repulsion* of the cylinder A D, that is—

$$= \frac{4\pi\rho(r-2a)}{3} + 2\pi\rho\left\{a - \sqrt{a^2 + b^2} + b\right\}, \quad (\beta)$$

The excess of the attraction at Q over that at P—that is, the difference of the expressions (α) and (β)—is

$$\frac{8\pi\rho a}{3} + 2\pi\rho\left\{\sqrt{4a^2 + b^2} - 2a - b\right\}$$
$$= 2\pi\rho\left\{\sqrt{4a^2 + b^2} - b\right\} - \frac{4\pi\rho a}{3}; \quad (\gamma)$$

and, according as this expression is positive, zero, or negative, the

attraction at the top and bottom of the mine is a matter of sufficient simplicity.

Though it is tolerably obvious that this method of determining the earth's attraction must be even less trustworthy than experiments of the Schehallien type, the method commended itself to the mind of Sir George (then Professor) Airy, and after two failures in the Dolcoath mines, he had the method tried in the Harton Colliery, near South Shields, where a depth of 1,260 feet was available. It is not necessary to describe the contrivances by which two pendulums were compared, one swinging at the top the other at the bottom of the mine, the pendulums being interchanged after intervals of 104 hours and 60 hours—that is, each working 104 hours above and below, and then each working 60 hours above and below. The work was conducted with great care and skill by Mr. Dunkin, of the Greenwich Observatory, to whom, however, no portion of the credit has hitherto been given in treatises on astronomy.

The observations showed that at the foot of the mine either pendulum gained two seconds and a quarter per day, showing that gravity was increased by $\frac{1}{191\frac{1}{3}\frac{1}{60}}$ part. This result cannot be sensibly in error, so carefully were Mr. Dunkin's operations conducted. But the inferred increase of density towards the earth's centre—that is, the deduced mean density of the earth—can by no means be regarded as ascertained with corresponding accuracy. We do not make an ordinary foot-rule more precise for measuring purposes by careful and complicated experiments on the changes it undergoes under the varying influences of temperature, moisture, and so forth—it remains a foot-rule still, with all a foot-rule's shortcomings as a measurer. The complicated calculations and corrections effected by Mr. Dunkin did not even touch the real defects of the mine method of weighing the earth; it remained rough and untrustworthy. A comparison of the final result with that obtained by experiments of the Schehallien class—which, though certainly not trustworthy, were at least as trustworthy as the mine experiments—suffices to show how little either method can be trusted. The earth's mean density, as calculated by Mr. Airy from the Harton experiments, was 6·565 times that of water, and the results of the mountain and mine methods combined appear as follows:—

	Mean Density (Water's = 1).
Maskelyne's Schehallien experiment (corrected by Playfair)	4·713
Carlini's pendulum experiments on Mont Cenis (corrected by Giulio)	4·950
Colonel H. James, from attraction of Arthur's Seat	5·316
Dunkin and Airy, from experiments in Harton Colliery	6·565
Mean	5·386

The mean value is probably, as we shall see, near the truth; but as the greatest value differs from the least by 1·852, or more than a third of the mean, the results—except Colonel James's—are discredited by the very circumstance that the mean value is nearly right; and all three *methods* are discredited, the correctness of Colonel James's result being thus shown to be merely accidental. If the length of a piece of ground had to be measured, and one workman said that measuring it in a certain way he found it to be 471 feet long, while another using a different method made it 495 feet long, and a third, using yet another method, found it to be 657 feet long, their employer would not regard their work or their methods as satisfactory if he presently found that a thoroughly trustworthy measurement showed the piece of ground to be 550 feet long, even though that is not far from the mean of the results obtained by three unsatisfactory methods. And if, later, a fourth workman, employing one of those methods, deduced as a result 539 feet, trust in that method would not be greatly increased. It would be felt that either the approach of the result to the truth was accidental or it was more or less consciously forced.

Airy expressed the opinion that the result of the Harton Colliery experiment was comparable on at least equal terms with those obtained by other methods, though it differs by 20 per cent. from the mean of the results obtained by all methods, and the results presently to be considered do not differ by more than 2 per cent. from their mean value, nor by 4 per cent. from the general mean. I prefer the opinion of Sir Edmund Beckett (now Lord Grimthorpe), that the result of the Harton Colliery experiments "cannot be accepted," and is "not to be compared in value" with those obtained by the Cavendish experiment.

The ingenious Michell, to whom science owes the first satisfactory reasoning about the architecture of the sidereal heavens, devised the method of weighing the earth which is commonly named after the eminent chemist Cavendish, who first successfully applied it.

(To be concluded.)

attraction at Q is greater than, equal to, or less than the attraction at P. Putting (7) equal to zero, we get

$$3\sqrt{4a^2 + b^2} = 3b + 2a$$

or

$$36a^2 + 9b^2 = 9b^2 - 12ab + 4a^2$$

that is

$$32a = 12b.$$

Hence, if b, the radius of the cylindrical mine, is equal to four-thirds its total depth, the attraction at P will be equal to that at Q. If the mine be wider, the attraction will be greater at P than at Q.

All other cases may be similarly treated, though, of course, the problem will not in all cases be so simple as the above.

COAL.

By W. Mattieu Williams.

MINERS' LAMPS AND COLLIERY EXPLOSIONS.

HAPPILY for themselves, few or none of my readers have any practical acquaintance with absolute darkness. With the exception of a skilfully devised horror the dark punishment cell in some of our prisons—scarcely any place can be found above ground where such darkness prevails. But in a coal-pit, without lamp, it exists in perfection. The lighting of a coal-mine is a serious problem, not because illuminating gas is dear, but for the opposite reason. Lead, copper, and other mines in which metals and their ores are worked, are lighted by the primitive device of wearing a candle in the front of one's hat while travelling down the shaft or along the workings, and sticking it in a miner's candlestick, a lump of clay, which is superior to ordinary candlesticks, inasmuch as it may rest on the ground or constitute its own bracket by being dabbed against a wall, or take any other position required.

Primitive oil-lamps of pattern closely resembling those found so abundantly in Pompeii, or metal lamps with a hook at one side for attachment to the hat or hanging to ledges, are used, and others with a spike below for similar purpose; but the candle and lump of clay is the general favourite. Paraffin lamps have been lately introduced.

Candles and such lamps may be used in some coal-mines, but these are exceptional, the majority of coal-mines being "fiery." This means that hydrocarbon gas, which has been

occluded or imprisoned for ages, starts forth on breaking down the coal, and may accumulate to a dangerous amount. So far as I have been able to learn, no coal-mine is free from "fire-damp;" in those that are worked with naked lights, "blowers" of gas may occasionally be heard, and seen when the men apply their candles to them, producing great jets of flame by their ignition.

Mr. Galloway has now satisfactorily proved that hydrocarbon gas is by no means the only source of dangerous explosions. Coal-dust mixed with air forms an explosive of terrible potency, and in most of the great colliery explosions it has been a serious factor, in some cases probably by far the most serious. A small explosion of gas, which alone would do no mischief, may operate by blowing up and firing the dust in its immediate neighbourhood; and this secondary explosion may do the like further on, and thus the blown-up dust may act like a train of gunpowder with the most terrible results. The drier the pit and workings, the greater is this danger, and as we descend to deeper and deeper seams, dry workings become more and more common, and thus the coal-mines of the future will become progressively more and more dangerous.

We read in pretty books about the miner's glow-worm lamp, and a pretty picture is thrown upon the magic-lantern screen of the lecturer, displaying a collier at work with a bottle full of these pretty creatures hanging by his side to cheer and guide him in his work. I doubt whether such a pretty lamp ever existed outside of these pretty books and pretty pictures. It may have been tried, but, having kept a few pet glow-worms for a couple of years in a fern case, and watched their habits, I conclude that they would object to being bottled in crowds, and would not waste their illuminating energies when thus imprisoned, especially as they light up for the purpose of courtship only during a short courtship season.

The "steel mill" was really used. It was a wheel with steel periphery, which, when rapidly rotated with a flint pressed against it, threw out a shower of sparks. These gave sufficient light, but they were also capable of firing the gas. I have illustrated that to a class by thrusting a brightly-heated iron wire through a bladder containing a mixture of hydrogen and oxygen gases, which thus treated explodes instantly. The sparks of the steel mill are simply incandescent particles of steel.

The introduction of the wire-gauze lamp altered all this. Serious explosions that occurred in Durham in 1812 led to the formation of a Society for the Prevention of Accidents in Coal-mines. It was at a meeting of this society in Sunderland in 1813 that Dr. Clanny, of Newcastle, exhibited his first lamp. He had worked upon the problems for some time. George Stephenson, then a humble engine-wright at the Killingworth Colliery, Newcastle, was doing the same, and practically introduced a wire-gauze lamp in 1815. His first lamp was ready on October 21, further improved on November 4, and fairly and practically in use November 30 at Killingworth under the name of the "Geordie Lamp." I will not enter upon the controversy respecting the personal merits of the different inventors beyond expressing my opinion that the merit of Davy was rather that of demonstrating the *rationale* of the action of the wire gauze in resisting the passage of flame between its meshes than of the invention of the lamp. There can be no doubt that too much has been claimed for Davy. Smiles, in his Life of George Stephenson, concludes that the illustrious chemist and the humble engine-wright arrived by wholly independent paths at a knowledge of the facts concerning the non-passage of flame through tubes and small apertures.

The principle upon which the efficacy of the Geordie or Davy lamp depends may be easily demonstrated by lowering a piece of wire gauze upon a common gas flame. As the gauze descends it will be seen that the flame does not pass between its meshes, but is effectually extinguished when it touches the metal. On applying a light to the upper surface of the gauze another upper flame appears, which is evidently a continuation of the partially-extinguished flame below. The gas passes between the meshes, but the flame cannot. Neither can a flame travel through cold metal tubes of small bore; but if either the gauze or the tube be made red-hot, it no longer stops the flame. A further demonstration is afforded by making a candle with a small thread wick, and when the wick is lighted passing over it a metal ring with an opening equal to the whole width of the flame. Although presenting no mechanical obstruction, the flame is completely extinguished by the cold ring.

The reason is very simple. The flame is due to the energetic combination of the hydrocarbon gas with oxygen, but this combination does not occur unless the gases be heated to a certain point. This heat, which is necessary for the continuance of the combustion, is carried away by the metal, which is a good conductor. The potency of metal in carrying away the heat of a flame is well shown by stretching a pocket-handkerchief, or piece of rag, over the convex side of the bowl of a silver spoon, and plunging the fabric into a gas-flame. It may be held there for some time without being even scorched, but if the experiment be repeated on a wooden spoon a hole is rapidly burned in it. The flame of a jet that is issuing with some force—as from a blow-pipe or Bunsen burner—may pass through the gauze according to velocity of issuing gas and size of mesh. Also, if the gauze is red-hot, its power of obstructing the flame is lost.

These facts indicate a limitation to the practical efficiency of the miner's lamp. When surrounded with gas outside, the space within the gauze is filled with flame, and this warns the miner of his danger. But the warning may itself be fatal if he becomes alarmed, and rushes forward too rapidly, or sways his lamp carelessly, and thus produces a through current that shall blow the inner flame outward. It is rarely that a human being is placed in a position demanding more of true courage than that of the miner when the flame of his lamp wick first elongates, then is surmounted by a blue cap, and finally flashes into a lambent flame that fills the lamp. He must hasten to the shaft for his life's sake, for if he is too tardy the gauze will become red-hot. If he rushes forward, or otherwise moves his lamp with a speed exceeding 4 or 5 feet per second, he will probably kill himself and all his comrades. In the midst of this dilemma he knows that others are in the same position, and that lack of courage and coolness of any one may be destructive to all.

A number of devices have been adopted to diminish this danger, far too many for me to describe or even name here. Double gauze, glass protection outside the gauze, as in the "Geordie," are among these, and are more or less effective, but none are perfect. My surprise is not that so many colliery explosions occur, but that they are so few. The flippant comments on the ignorance of the miners that are so commonly made are really due to the ignorance of the commentators. The old story of the man who was descending a dangerous pit with a lighted candle on his hat, and, when reprimanded, replied, "Well, arnt I got my Davy?" may amuse a magic-lantern audience, but those who know the simple but shrewd-minded colliers are amused in contemplating the self-sufficient silliness of the audience, who can suppose that their fellow-men, who are daily carrying their lives in their hands, are ignorant of the primary conditions upon which their safety depends.

It is true that familiarity with any danger induces a

certain degree of recklessness, and possibly some disasters may have arisen from foolhardy fellows uncovering their lamps to light their pipes; but every collier can gauge the amount of explosive gases surrounding him by the state of his lamp flame, and there is such a thing as public opinion underground. Any man known to be guilty of risking the lives of all his fellow-workers for the sake of a smoke would not escape unpunished by those upon whom the outrage had been committed, especially by the women above ground with vested interests in husbands below.

Considerable progress has recently been made in the electric lighting of mines. Portable batteries and accumulators are used as sources of power. Their weight, as at present constructed, is a great objection. This will probably be diminished with further progress. But even this will demand protection, as the breaking of the glass bulb of an incandescent lamp would expose a filament of burning carbon nearly as dangerous as a flame. Perhaps their worst defect is the absence of the warning which is given by the behaviour of the common lamp flame.

LIFTING GREAT WEIGHTS.

LIFTING exercises are open to the objection that they tend only to increase the strength of the body, activity not being increased by any of them. A man who follows lifting work only will be a slow mover, and what Blaikie calls "muscle-bound," meaning that the muscles themselves, by their undue or disproportionate development, limit the play of limb. Without agreeing with him that the full degree of lissomeness which can be attained by exercises of a contrary tendency is desirable, we must admit that a muscle-bound condition is disadvantageous. Yet lifting exercise, pursued with due consideration of the necessity for an adequate amount of correcting exercise, is exceedingly useful, because in our daily life we constantly find occasion for the use of the lifting powers of the body.

Lifting from the shoulder ought to be but a portion of the lift from the ground to the full height of the upstretched arm or arms. To lift a pair of weights from the ground, slowly raising them to and past the level of the shoulders, and thence to thrust them upwards, still slowly, till the arms straighten, is a much severer exercise than to raise the same weights from the shoulder only. And this last, again, is more trying than to send up the same pair of weights with sufficient velocity to carry them past the dead part of the lift, which ranges from the height of the mid-chest to a few inches above the shoulder. I, who can make no claim to exceptional strength, can readily (or could a year or two since, and suppose I still can) lift any one not exceeding 140 or 150 lbs. in weight to the full upward reach of my arms if I start right; but I could not lift two-thirds of that weight slowly from the ground to above my head, or even slowly from the height of my waist. The way to lift any one easily in that manner is to place one hand upon the waist, passing the other under the knees so that the body of the carried sinks somewhat, a motion resisted by the elasticity of the arms and legs of the carrier and converted into an upward motion from a height favourable to lifting—such rapidity of rise being communicated that the body is carried over the dead part of the lift, after which the arms readily straighten and carry the weight to the full height. The exercise is not to be recommended, however, as a safe one for the person lifted, because the person lifting has to shift the hold of both hands on the way up, and if this is not deftly done an unpleasant fall is apt to result. (The last time I attempted a feat of the kind I was standing before a tall wardrobe with my wife, when she remarked, joking, "I wish I could get into that top shelf"—into whose recesses she had been vainly reaching. I naturally pretended to take her in earnest, and in another second she was on the level of that shelf, but I fear not more favourably placed for getting what she wanted than when on the floor. In that case, however, there was no danger of a fall because of the wardrobe's position.)

Nathalie, a French female gymnast, was able, according to Farini, to take two 56 lb. weights from the ground, one in each hand, and put them slowly above her head. Let those who can easily put up two such weights with a quicker motion, try the slow movement, even with much smaller weights, and they will recognise the difference. Farini pointed out to Charles Reade that putting up an agile gymnast is mere child's play to this, "because, in dealing with the live object, the strong stoops, the agile springs, and the strong arms are at an angle of 45 before the weight tells; now," proceeds Reade, "the arms, as they near the perpendicular, can hold up three times the weight they can put up." (He should rather have said that the arms as they near the perpendicular can put up three times the weight they can lift up before they reach that position: they can, however, lift up from the ground twice the weight they can push up to their full upward reach.)

Lifting at arms' length exercises, so far as the arms are concerned, an entirely different set of muscles from those used in putting up weights. Nor can strength be so satisfactorily tested, or compared, by the former as by the latter exercise. A long-armed man is here at a disadvantage, and judging by the weight he can lift, might appear weaker than a short-armed man really of less power in the arms. I remember the disgust with which when at college I found men whom I knew to be no stronger than myself able to lift greater weights at arms' length, till I noticed that the unusual length of my arms, which span horizontally fully half a foot more than my height, put me at a disadvantage, owing to the extra leverage involved. Our strongest man at Cambridge University then (1856 to 1860 was my time) was, I believe, Mr. Duncan Darroch, who rowed "four" in the 'Varsity boat in 1858, the year when Cambridge rowed the famous race (which they won by 2 feet 6 inches) with the London Club eight, manned by Casamajor, Playford, the Paines, and other famous oarsmen of the days before sliding seats were invented. Mr. Howard Snow, afterwards one of the masters at Eton, and now—but with altered name—head master at Cheltenham College, and himself a famous oarsman, stroke of the Cambridge boat in 1857 (and bracketed first in classics in 1858), wrote of Darroch, in somewhat doggerel rhymes:—

> He'll lift as much as any other one can
> Will Duncan;
> He has the strength of an entire barrack,
> Has Darroch!

Darroch could lift a 56 lb. weight at arms' length. But Darroch was short-armed for his height, and, as I remember him, a muscle-bound man. Few men can expect by any amount of training and practice to acquire the power of lifting such a weight as 56 lbs. at arms' length. Thirty pounds would be a very fair arms'-length lift for men of average strength; and even that would require exercise and training.

Very good exercise in lifting can be obtained without special apparatus, as by lifting chairs in different ways. Thus the chair may be lifted at arms' length by a front rung grasped knuckles upwards or knuckles downwards; or by the lower end of a front leg—the back being in every case brought to a vertical position, and so maintained while

the lift lasts. Strength may be tested either by the weight of the chair lifted, or by the time during which the chair is held out.

It is noteworthy that often the man who can lift the heaviest chair at arms' length in some particular way, may be surpassed by another when the mode of lifting is altered. And, again, those who lift the heaviest weights in these ways are not always those who can maintain their hold longest. Resolution comes in as a factor in the last-named test. One will often see a great and strong but easy-going man lift out at arms' length a weight which another cannot bring for a moment to that position, who yet will not hold out half that weight for half the time at which it will be held out by the weaker, whose resolute will enables him to sustain his hold to the very last.

In all these forms of lifting the arms are chiefly considered. Yet in reality the lower limbs have their work to do, not only in sustaining the extra weight, but in sustaining also the weight of the body. It is only in exercises which require the body to be lifted from the ground that the legs get no work. Such exercises are among the severest tests of strength, because they reverse the usual order of things. To a sloth, accustomed always to have its weight suspended, such exercises would come naturally: to men they involve always a certain extra amount of difficulty as compared with exercises in which the sustaining power of the legs is called into action.

I need not touch on feats in which the body is merely raised from the ground a certain number of times by the action of both arms or of one arm only, or from a single finger—as can readily be done after sufficient practice. I do not, indeed, know what is actually the "record" for feats of this sort. But for the actual lifting power of the arms, I know of no feat ever accomplished which has surpassed one which Nathalie, the lady mentioned above, was in the constant habit of performing. She could extend her body from the horizontal bar, supported only by one hand grasping the bar, knuckles downward; then (for so far the feat was not uncommon) she could put the other hand behind her and take the bar with it, holding the body horizontally by that hand. Farini told Charles Reade that he had never met with a male athlete who could do this; yet, added Reade, "it was not knack: it was complete either-handedness, coupled with gigantic strength."

Speaking of lifting the weight of the human body, I may touch here on a somewhat absurd fancy many entertain about an experiment in which four persons lift a fifth on the tips of their fingers. I have repeatedly heard this experiment spoken of as something very marvellous. The person to be lifted draws in his breath and stiffens himself generally; the four who are to lift him also draw in full breaths, "and then," the story goes on, "he is lifted without any apparent effort"—meaning, of course, that he is lifted quite easily. As, indeed, why should he not be? The person lifted usually weighs about 120 lbs., and each of the four lifters would think it no great effort to lift 30 lbs. with the forefinger. Drawing in a full breath is always a good preliminary process for any muscular effort: and after this process each of the four lifters does easily what he can always do easily, lifting not the fifth person bodily, but just a fourth portion of his weight—30 lbs., or 40 at the outside.

In all lifting feats the lower limbs are really taxed, even though the arms seem to do the work. To suppose otherwise were to make a mistake as foolish as that of the Irishman (though why such stories should be put always upon Irishmen I do not know) who thought to relieve his horse by putting the meal sacks, which formed a large portion of his load, over his own shoulders. Lift a weight how we may, the legs have to bear it. It will be understood, then, that whatever weight the arms may seem to lift in any experiment, the whole body can be made to lift much more.

In all stories of great weights which have been lifted it will be found that the lifting power of the whole body has been in question. This, indeed, is true of all the most remarkable feats of strength which have been recorded. One need not consider the feats of a Hercules (*i.e.* Herakles) or of a Samson, seeing that both one and the other is a sun-god, of whom naturally wonderful feats are narrated. (The very name Samson means the glorious sun.)

Feats actually noted and recorded are sufficiently surprising without considering feats purely mythical.

The famous strong man, Topham, of Islington, may be considered a fair illustration of those cases of exceptional development of strength—without exceptional muscular development—of which we hear from time to time, as we hear from time to time of men remarkably large or remarkably small. It would seem as though some physiological peculiarity in such men enabled them to get from their muscles much more nearly their full action than (as physiologists know) is ordinarily possible. Topham could take a kitchen poker and twist it round his neck in such sort that four or five strong men were unable to untwist it—a feat which he accomplished as readily as the twisting. He could squeeze a pewter pint-pot flat in his hand, double up a crown piece (familiarly known in former times as a "cart-wheel") with his fingers, and break a short piece of tobacco-pipe by side pressure between two fingers opened out in V-shape. This last feat, as depending on the action of muscles very seldom trained to do any work, is specially remarkable; it serves to confirm the belief that Topham was able, as it were, to charge his muscles with an exceptional supply of nerve force. They were certainly not unusually developed, though of course they were above the average size.

Van Eckeberg, an athletic German, lifted a weight of nearly 3,000 lbs. by the use of the strength of his whole body. He stood within a well-balanced framework heavily loaded, and to be raised by straps attached to a strong waistband. The lifting power was obtained by straightening his lower limbs (almost straight just before lifting). The heavily-loaded framework was thus raised an inch or two, a slight swaying movement showing the spectators that it was really free from contact with the ground.

So powerful was Topham's frame for this sort of work, that he pulled against a strong dray horse—his body being in a horizontal position, and the pull of the horse being resisted by the pressure of his feet against two stirrups, so that the action was akin to that of Van Eckeberg's in the lifting experiment. Unfortunately, after he had successfully resisted the pull of one horse in this way, he had one of his knees shattered in an attempt to pull against two horses, and thereafter he was disabled from the performance of feats of this kind. Great care indeed is required in all lifting exercises to avoid any sudden change in the direction of the pull.

The secret of this great lifting power of the legs in such work lies in the fact that the action has that exceedingly effective leverage which is employed in the Stanhope Press—familiarly known, in fact, for this very reason, as "knee leverage." When the legs are nearly upright the knees may be perhaps half a foot from the position they take when the legs are straightened. While they move through this half foot the body is not raised more than perhaps half an inch; consequently the power used in straightening the legs is multiplied into a twelve-fold greater lifting power. It is because of this powerful knee-straightening action that lifting exercises are apt to develop abnormally the muscles of the lower and inner end of the front thigh.

To lift a thousand pounds on the health-lift is no very remarkable feat for a person of average strength, giving sufficient time daily for a few months to practice. Mr. Blaikie learned in this way, at the age of seventeen, to lift a thousand pounds after only six months' practice. Those who prefer to lift an actually measured weight will find it necessary to adopt some such plan as was employed by Topham, preparing a framework to bear the weight, and standing in its midst so as to lift the weight by means of symmetrically-attached straps. For the body cannot, when all aslant, bear such a weight as a thousand pounds.

Whether such exercise is good for the body as a whole depends a good deal on the opportunities which a man has for correcting an abnormal development of the lifting muscles by means of other exercises, increasing the development of other muscles and giving activity as well as strength to the frame.

NOTES ON AMERICANISMS.

Habitan. Corruption for the French word *habitant*, a landed proprietor on a small scale. The word is seldom heard outside Canada on the northern side, and Louisiana on the southern. When heard in the middle States, it usually has a sound as entirely different from the French pronunciation as "Movey Star" is different from "Mauvaises Terres," or "Lagrange" (rhyming with "range") from the French "Lagrange."

Had have, Hadn't oughter, and kindred combinations and abominations are heard about as frequently in the States as in the old country. Would that Bartlett "had have" been justified in implying that Americans only use expressions which they "hadn't oughter" such as these.

Hail from, To. The good old sea-phrase, "hail from" for *come from, belong to*, is heard in America as in England, though America has done her best to destroy her own sea-carrying trade. But to call "Hail from," thus used, an Americanism, is as absurd as it is to call "Hang out," for *live inside*, American. Bartlett naturally does both, seeming to know as much about English usage as the *Saturday Review* knows about Americanisms.

Hammock. 1. The use of this word for a swinging-bed, though of South American origin (Spanish *Jamaca*) has now been for more than a century so widespread that to regard it as an Americanism would be absurd. The use of the "hammock" as an open-air couch in gardens, on porches, and so forth, is, however, undoubtedly much more common in America than in the old country, the summer climate inviting to lazy ways of lying (or "laying," as nine-tenths even of the "society people" of America call it), reclining, sitting, and so forth. The grandsons—aye, and the sons, too—of men who in England would be ashamed to be lolling and sprawling half the time, loll and sprawl all the time in America. But for the constant infusion of new blood, the American population would develop in a few generations into a race no longer using chairs, except of the lazily rocking sort, and regarding the upright position as involving an exhausting tax on the energies.

2. The word *Hammock* is used in the Southern States, for "a piece of ground thickly wooded, whether a prairie or a hill, and distinguished from the immense forests of thinly scattered pines, which with a few exceptions cover the whole face of the country" (where the word "hammock" is in vogue). This definition is from an article in the *North American Review*. The word is not found in either Webster or Worcester. I can find no evidence as to its origin, since it is clearly quite distinct from the old word "hummock" for rounded knolls. It is painful to have to admit ignorance about an Americanism, with the *Saturday Review* ready to pounce on every indication of my having undertaken in these "notes" a task for which I am totally unfitted. I may, however, remark that even as I had been myself using for years two of the Americanisms which that omniscient weekly strove to exploit as "recent inventions," I know by actual experience what "hammock land" is, though I am unable to say how the word "hammock" came into use. I write these lines with half a dozen tracts of hammock land in view, and with one such tract within five minutes' walk, a portion of which has been cleared away for my own special "potato patch" (the "potato" growing on it being at present grape vines, however). I must ask the readers of these "notes" to excuse me for occasionally reminding them that I have had (and have) somewhat exceptional opportunities for comparing American with English expressions and ways. I should not have thought of so doing had not the greatly daring review which has recently made itself for ever famous by attributing to Sir William Jenner the invention of vaccination—when he was presumably a very young man, a century ago—written of my modest "notes" in terms implying that they had been evolved from my moral or immoral consciousness. Yet are there some things, strange to say, which the average *Saturday Review* writer really does know, and know by the best of all possible evidence, and among these is the fact that some writers would for a consideration pen a treatise about the Himalayan Snows, with no wider experience than a back attic in Grubb Street would afford, or discuss the campaigns of Napoleon or of Moltke with no better knowledge of the military art than may be obtained in school-boy scrimmages.

Hand.—It will hardly be believed that Bartlett includes the expression "hand" used in reference to proficiency—as when we say that a man is a "good hand" at fighting, or a "poor hand" at accounts—among Americanisms; but he *does!*

Handsome for *generous*, is of course as thoroughly English as any usage can well be. But Bartlett who includes this usage among Americanisms, overlooks an expression which, though occasionally heard in England, is so much more commonly heard in America, that it might well have been one of Bartlett's set. In America the expression "he did the thing handsome" would not be thought remarkable, though a small percentage might be aware that it is incorrect.

Hang. To get the "hang" of anything, meaning to learn its nature and peculiarities, is an expression which has long been in use in the old country, but is perhaps oftener heard in America.

Hang, Around, To, signifying to loiter about, is only an Americanism in regard to the word "around," which is used here where in England we should say "about" or "round." I am inclined to think that the word "around" constantly used in America where we say "round," is in reality the more correct adverbial form, "round" being a corruption by clipping, which in strictness should be written "'round." I have myself become so accustomed to the American usage that I have found the word "around" making its appearance frequently in my writing, insomuch that an English friend of mine who is kindly helping me in the revision of my "Old and New Astronomy" has had occasion to alter "around" into the more usual "round" in quite a number of places. I was thus led to examine my earlier works, written before I had lived in America, as I have during about six years out of the last fifteen, partly expecting to find that I used the word "around" as freely then as now. But in my "Saturn and its System" I find that where I should now be apt to write "around" I wrote either "about" or "round," the

former much the more frequently, probably because the word "about" is constantly used in mathematical works when rotation or revolution is in question. In passing, I may remark that my first acquaintance with the American usage was formed when (somewhere about the year 1855) I heard Mrs. Florence as the "Yankee Gal" singing the well-known song "Bobbin' Around." But the refrain "As we went bobbin' around," familiar though it became, did not so far affect my English as to make me write of Saturn as bobbin' around the sun. He still continued sedately, even Saturninely, to "revolve about" the ruler of the solar system.

Hang Out, To. Bartlett not only regards this as an Americanism, but identifies it as Western, almost as Chicagoese. It was already old in England before Chicago began to be a place. Those elegant medical students, Messrs. Bob Sawyer and Benjamin Allen, could have enlightened Mr. Bartlett more than half a century ago about this bit of old English slang.

Hang Up One's Fiddle, To. To give up; an expression frequently heard in the Middle and Northern States, but probably of southern (nigger) origin. "Hang up um fiddle and um bow-ow-ow" will be recognised as part of the refrain of a very ancient nigger song.

Happen in, To. To come in accidentally, short for "to happen to come in."

Happen on, To. To happen to meet, short for "to happen to come upon" such and such a person. The later, but now not very recent, Americanism for this idea, is "to strike." Where of old a man would say, "I happened to come on our friend Mr. Jones yesterday," an American would formerly have said (and many Americans would still say), "I happened on friend Jones yesterday," while an American of to-day, especially if a westerner, would be apt to say, "I struck Jones yesterday."

Hard Case. A term not unknown to the British police for an irreclaimable criminal, extended as an Americanism to hopeless rakes, blackguards, drunkards, poker-players, *et id genus omne*.

Hard Pan. Bartlett describes this as primarily a geological term; but though a geologist may occasionally speak of a hard and water-tight stratum of hollow shape as a hard pan of clay or gravel, or describe such a stratum as the hard pan below such and such strata, yet the term "hard pan" has not in this indefinite form yet taken its place in the geological vocabulary. "Hard pan" as an Americanism, signifying the bottom of things, is doubtless derived from mining experience. A man might dig for gold through stratum after stratum without altogether losing hope, till he came down to the hard water-tight stratum below: but when he had thus reached "hard pan" he gave up. To say, then, "We are coming to 'hard pan,'" or "we have now reached 'hard pan,'" is equivalent to saying, We are now beginning to know with certainty, or we can now form a definite opinion. The idea is more poetically expressed, but with the same inner significance, in Wordsworth's well-worn lines:—

> To the solid ground of nature
> Trusts the mind that builds for aye.

Hard Row to Hoe, A. A tough business to get through. Haliburton has made us familiar with this expression as an Americanism, but it may be regarded as surely of English agricultural origin.

Hardshell, used as an adjective for thorough-going, is probably a pure Americanism, since the term was originally suggested as the difference between the hardshell and soft-shell crab, and we have no soft-shell crabs in the old country.

(*To be continued.*)

THE STARS OF OTHER TIMES.

(*Continued from page* 112.)

THE southern stereographic map in the present number needs no separate explanation, being drawn on the same plan as the northern, and having the same general interpretation.

It is, however, altogether the more interesting map of the two. The stars north of the ecliptic have always been visible up to about 66° 30′ north latitude, and the stars in the northern map, which ranges 10° south of the ecliptic, have been always visible, at suitable times and seasons, as far north as about 56° 30′. But stars shown in the southern map are for the most part such as are only brought into view in northern latitudes by the slow precessional motion of the equator along the ecliptic, and after being thus in view for a time—hundreds, or it may be thousands of years, according to their position on the star-sphere—are carried out of view again, so as to be unknown in the latitudes where they had so long been known, during hundreds of future generations. Moreover, the aspect of the southern star groupings as they rise to their greatest height above the horizon of northern latitudes, changes continuously with the precessional movement, much as the aspect of northern star-groupings changes during the night. As Cassiopeia and Andromeda, for example, Auriga, Bootes, and Cepheus, are sometimes presented in such positions that the figures associated with them have the uprightness desirable with men and women, but at other times are aslant or inverted, prone or supine, so the ship Argo and the altar Ara have held very different positions at their culmination in past times than now, and will continue slowly to change in position as the precessional motion continues.

Doubtless it is due to such changes as these that several southern constellations are no longer recognisable from any resemblance between their configuration and such objects as altars, ships, animals, and men. For a star-grouping which will readily suggest to the imaginative mind the idea of some known object when that object, so imagined, would be in a natural attitude, will suggest no such idea in any other position. To see this we have only to consider the case of the constellation Orion. In one position this grand star-group suggests the idea of a giant holding a shield of some sort in front of him, and standing upright, while in another it suggests the idea of the giant raising himself towards the upright position, and in yet another, that of the giant slanting forwards as if running down a slope. But seen near the horizon at the equator, when the giant would have to be imagined either prone or supine (supine in the east and prone in the west), the constellation does not suggest the idea of a man at all: while in the southern hemisphere, though the idea of a giant is again suggested, it is a giant of another figure and presented in a different way, the shoulders of our northern Orion representing the knees of the southern giant, and *vice versa*.

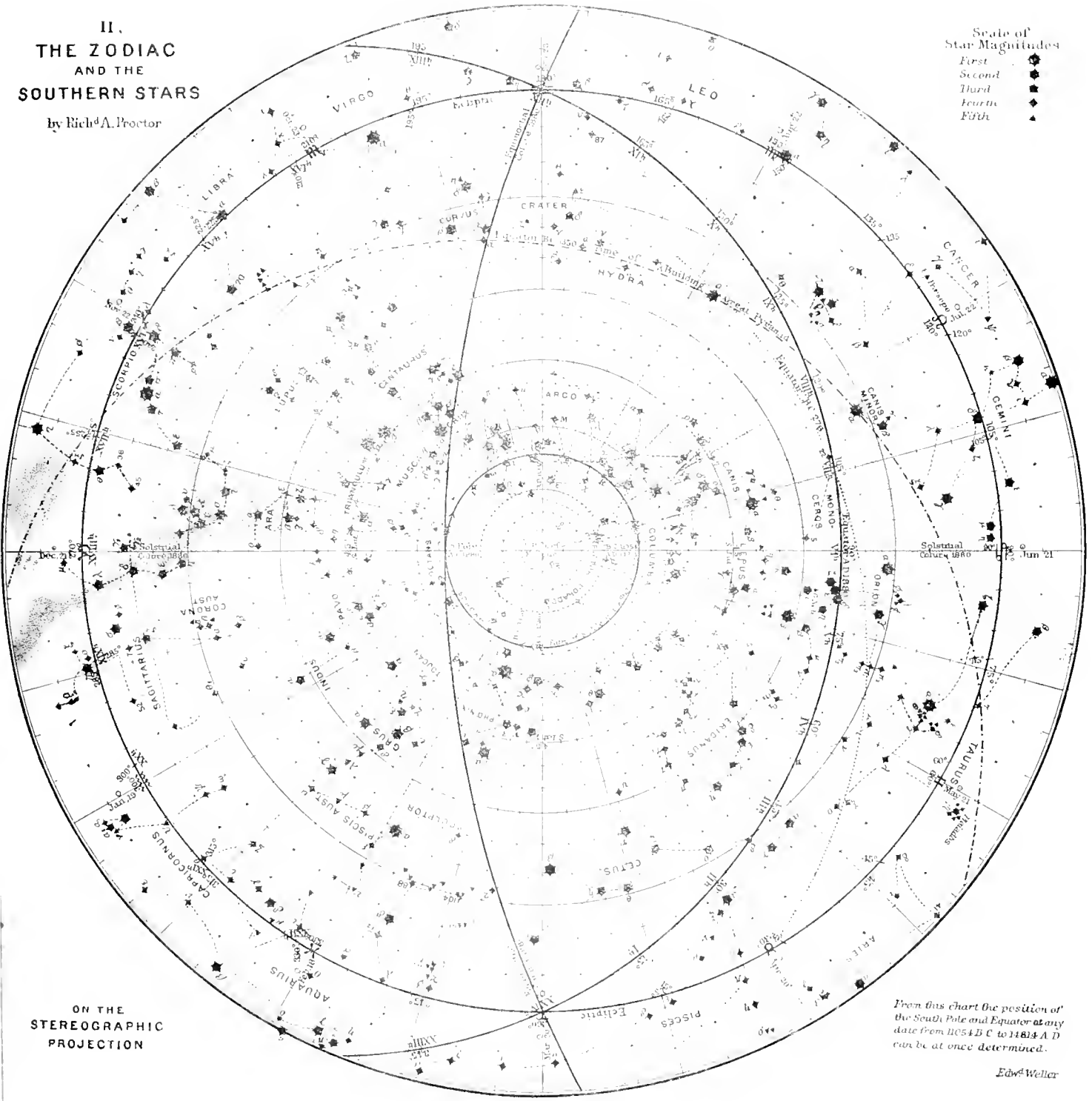
Thus it becomes a problem of some interest to determine how the star-groupings associated with different objects and figures appeared when those particular constellations received their names: for thus not only may we be able to correct our determination of the date of such naming, but we may obtain evidence more or less satisfactory respecting the occurrence of changes among the stars, we may be able to find some explanation of the ideas of men in old times respecting the constellations, and we may even be able to find an interpretation of certain religions which were associated in far-off times with the stars.

The study of the southern star-chart will serve to show

II.

THE ZODIAC AND THE SOUTHERN STARS

by Rich^d A. Proctor



ON THE STEREOGRAPHIC PROJECTION

From this chart the position of the South Pole and Equator at any date from 11054 B C to 11814 A D can be at once determined.

Edw^d Weller

how the celestial equator was situate with respect to the southern constellations—(1) at the time corresponding to the building of the Great Pyramid, and (2) in the days of the early Greek astronomers. I would invite special attention to the position of the ship Argo, which was horizontal when culminating at the former epoch, aslant in the days of Hipparchus and Ptolemy, and is now more aslant still. As a ship may be said to be in her natural position when on an even keel, we have in this result evidence of some force to show that the constellation received its name at the earlier period, or more than 3,000 years before the Christian era. At any rate, further inquiry into this question is suggested.

(*To be continued.*)

EVOLUTION OF LANGUAGE.

By Ada S. Ballin.

X.—ROOTS AND THEIR USES.

HAVING spoken of the probable origin of a large number of roots, we can now turn with interest to the use of roots in the various languages known to us. As Mr. Garnett announced in 1849, after a searching analysis of more than eighty languages, word endings were originally uninflected pronominal roots, with a locative signification. Roots are all that is primitive in language, and sentences are even now found wholly composed of these elements.

In a private letter to me, Mr. Frederick H. Balfour—than whom few are more familiar with the Chinese language and its dialects, as used at the present day, as well as with the classical or literary language—once observed: "I may safely say that it would be difficult to write one sentence which did not consist of roots, for every character embodies a root idea, and is used for ordinary purposes, in literature as well as conversation, without inflection."

According to the manner in which roots are combined, we find three stages of language:—

I. The radical, in which, as in Chinese, roots are used independently, supplying the place of all parts of speech, as *ì chang*, "employ stick," meaning "with a stick."

II. The agglutinative, in which two roots may be joined to form a word, in which compound one root may lose its independence, the stage called by Max Müller, to whom this classification of language is due, the terminational, exemplified by the Turanian family, in which the root stands out clear from the termination, as, for example, from the Turkish root *bakar*, to regard, we have *bakar-im*, *bakar-sin*, and so in conjugating the verb.

III. The inflectional, in which two roots may be joined together to form words, both losing their independence in Aryan and Semitic languages.

As long as every word or part of a word is felt to express its own radical meaning, a language belongs to the first or radical stage. As a specimen of this stage, Chinese is the stock example; but although it is always regarded as a monosyllabic language, a large proportion of its parts of speech are formed of two characters (root words) joined or used in apposition, each of which supplements and explains the other. The combination thus effected presents a distinct dissyllable. As Sumner says:—"A word in Chinese *may* consist of *one* syllable, but, from the want of grammatical inflections, and from the limited number of syllables in use, a monosyllable is rarely intelligible when alone; it generally requires some adjunct to limit or strengthen its meaning."

Chinese words have neither classification nor inflection, and distinctions of case, number, person, tense, mood, and so on, are non-existent. The meaning of a character or word, and its place in the sentence, generally determines to what category of our grammar it belongs; but frequently auxiliary syllables and particles distinguish the parts of speech. The syllables which serve to strengthen the original notion expressed by the chief syllable denote the *agent*, an *object*, the *completion* or *expansion* of the chief idea, or "are purely *formative* in character, and produce nouns or verbs, adverbs or adjectives, as conventional usage has determined."* A noun, from its position, may become a verb, or it may so stand with another noun as to signify a preposition. Thus *hiá-shān*, "descend a mountain"; *hiá-fāng*, "lower room"; *shán-hiá*, "at the foot of a mountain," *hiá* in other combinations meaning "below"; *waí*, "exterior"; *waí-kwŏ*, "foreign countries"; *kwŏ-waí*, "out of the country." The Chinese word cannot therefore be regarded as really either noun, verb, or other part of speech, since, under different conditions, but without any change in itself, it may come to represent each in turn.

Chinese words which may be classed under our head of nouns, as far as regards their use or derivation, may be divided into three kinds:—1. Primitive nouns, monosyllables bearing their original signification, and generally used in the monosyllabic or crude form, such as *jîn*, "man"; *fán*, "rice"; *ch'á*, "tea." The class is not a large one, and the monosyllables are not understood by the Chinese when pronounced separately, being only used in connection with other words—as "a man," *yĭ kó* (one), *jîn*; *kĭ-fán*, "to eat rice" = "to dine"; *tsaù-fán*, "early rice" = "breakfast"; or *wán-fán*, "late rice" = "dinner"; and so on.

2. Nouns derivative, made by the addition of one or more formative syllables—a much more numerous class, which always remain nouns, while some of the former class may be used as verbs. The formative syllables in these nouns serve the same purpose as terminations in inflectional languages. Thus *jîn*, man; *kūng-jîn*, a workman; *sheù*, hand; *shwuì-sheù*, "water hand," a sailor; *ûr*, infant; *nû-ûr*, "a girl"; *jîn-ûr*, "a man"; *kiā*, "family"; *jîn-kiā*, "people." 3. Composite nouns, which are formed by the connection of two or three syllables, each of which retains its proper signification.

The same syllable may be repeated, as *naī-naī*, "married lady of rank"; or synonyms may be united, as *sîn-cháng*, "the heart, the feelings"; or a noun may be formed of two verbs, as *hîng-weí*, "actions," from two words meaning, 'to do." Nouns expressing the abstract notions of verbs are generally formed in this latter way, just as the infinitive is used in Greek and German—τὸ τυχεῖν, das Leben, das Haben, and so on. Two adjectives are united to form nouns, as *chīn-paù*, "precious-precious"=a jewel; *yiú-mán*, "sad-sorrowful"=sorrow. Many nouns are formed by placing generic terms, as, for example, the equivalents for *tree*, *stone*, *fish*, &c., after the special object; as we say *limestone*, *fir-tree*, and the like. Words expressive of time and place, generally used as prepositions or adverbs, also enter into the composition of nouns, as in the former examples: *tsaù-fán*, "early rice"; Ger., *Früh-stück*, "early piece"; *wán-fán*, "late rice"; Ger., *Abend-brod*, "evening bread," for the evening meal, supper; *kīn-jĭ*, "now-day"= to-day. Cf. the uses of τῦν and πάλαι.

The modes of expressing abstract notions are exceedingly interesting. A common method is to combine opposites, as "light-heavy"=weight, "many-few"=quantity, "long-short"=length, "high-low"=height, and so on. Others are formed by the addition of such words as *hĭ'í*, breath; *fūng*, wind; *sīn*, heart; *síng*, nature, disposition, faculty: thus—*i-k'í*, integrity; *liáng-sīn*, conscience;

* Sumner's "Handbook of the Chinese Language," p. 41.

mîn-fūng, nationality; *mún-k'í*, sadness. Others are formed in the same way as the other nouns mentioned above: thus *maì-maí*, "to buy—to sell"=trade; *fún-pĭ*, "to divide—to distinguish"=difference; *siaù-sîn*, "little-heart"=attention, and so on.

Diminutives are formed by the addition of words signifying "little" or "small," "child" and "infant." The distinctions of gender and number are similarly made by words prefixed or suffixed to the principal word. *nân* male, and *nŭ* female being prefixed to *jîn* to express the gender of the person spoken of, and *kūng* "male," and *mù* "mother" to names of animals, in order to distinguish their gender. The plural is expressed by the reduplication of the word, by prefixing some syllable meaning "all," "many," or "class," or by employing a numeral. The only case which can be distingnished by the form of the expression is the *genitive*, indicated by the particles *tî* in speaking, and *chī* in books; these are by nature demonstratives, and stand for the English apostrophe s, 's or s'.

Chinese adjectives may be divided into three classes in the same way as nouns; some may be looked upon as primitive, being seldom used in any but an adjectival relation, for example *haŭ*, "good" is generally used as an adjective, though, with a change of tone, it is *haú*, "to love."

Some monosyllables are used as verbs: but they are almost always assisted by some other syllable of cognate meaning, and thus the spoken language of China is polysyllabic rather than monosyllabic, as it is usually supposed to be. There is no distinction between *active* and *passive*, *person* and *number*, the context guiding to the meaning, and *mode* and *time* are similarly shown by the context and the conditions under which the sentence is spoken. The composition of verbs is similar to that of nouns, they being formed by (*a*) repetition as *k'áu-k'áu* "look, *look*"=*look*; (*b*) by joining an auxiliary to the primitive, as *tiĕ-sź*, "fall, die"= fall down dead; (*c*) by prefixing to one verb another denoting *power, origin, desire, intention*, &c., as *k'ì*, "arise, begin," *k'ì-tsó*, "begin to do"; (*d*) by placing verbs before or after others to denote intention or completion of the action, as *liaú*, to finish, *sź-liaú*, "is or was dead," *ì*, "already," *ì-chí*, "has arrived"; thus the past tense is expressed, and the future may be indicated by the addition of syllables meaning *wish, approach, certainly*, and the like, thus, "wish go" for *will* or *shall go*, "approach do" for *shall do* or *about to do*, "certainly walk" for *shall walk* or *must walk*; (*e*) by uniting two verbs as in (*b*), but the union of which gives a different meaning to its parts, as *kĭ-tĭ*, "to record, obtain"= *to remember*, *tseù-k'aī*, "walk open"= *to walk away*; (*f*) by adding the proper object to the verb, like the cognate accusative in Greek, a new verb being thus formed, as *kĭ* or *chĭ-fán*, "eat rice," for *eat* (any meal), *t'ing-mîng*, "listen to, order"= *obey*; there are still other forms, but these sufficiently indicate the system. Many nouns are used as verbs, the context only determining to which part of speech they belong; these are always monosyllables, as *tiĕn*=*a point, dot*, also *to punctuate, to blot out, to light, to nod*; *taú*=*a road, reason*, also *to say*; *schwŏ-kwá*=*conversation*, also *to talk*.

By a change in tone when speaking, the *voice* and kind of the verb may be changed, an *active* verb becoming *passive*, or a *transitive neuter* or *causative*—as *weì*, "to make, to do," changes into *wéi*, "to be made," "to be considered as."

A verb standing alone or as the first word in a clause generally serves as an imperative. The imperative is also marked by auxiliaries, signifying to *invite* or *beg*, to *cause, call, exhort*, and the like. The *passive* voice is sometimes expressed by auxiliaries, meaning "to receive," "to meet with," "to suffer," and so on.

In Chinese, then, the roots, although combined to express one idea, maintain their individuality of form, but signs are not wanting to show that even here the same agencies are at work which have brought other languages to the agglutinative stage in which the meaning of one root is lost, so that in the formation of the new word it becomes a mere appendage. Thus in Chinese "ten" is *shĭ*, and "two" is *úr*, for "twenty" the two are joined, and we have *úr-shĭ*; this process is clear, but a knowledge of the structure of language enables us to perceive that *twenty* was also originally *two*×*ten*. In Chinese what corresponds to our locative is formed in several ways, as by adding such words as *chūng*, the middle, or *núi*, inside. An old word *ì*, meaning to *use*, forms the instrumental, as the classical *i chang*, with a stick. In Sanscrit every substantive has a locative—for example, *hṛid* heart, *hṛidi* in the heart, the short *i* representing the same root which produced the preposition *in*, so that, like the similar Chinese usage, *hṛidi* meant literally *heart-within*. Other cases and the various forms of the verb have been shown to have arisen in the same manner.

As soon as such words as *li* in *ûŏ-li*, "at home," *li* originally meaning "interior," in, or *ī* in *ī chang*, with a stick, lose their etymological meaning, and become mere signs of derivation or of case, language enters on the second or terminational stage. By far the largest number of languages belong to this stage.

Thus in Chinese, and more especially in some of its dialects, a rudimentary form of agglutination may be observed. Modern Chinese are not aware that the locative suffix *li*, as in *ûŏ-li*, originally meant "interior," and in the Shanghai dialect *wo* is to speak as a verb; *woda*, a noun "word" with *wodaku*, used like our genitive; *tang-woda* as accusative, and *pela woda* as a dative. Similarly in agglutinative languages traces of inflection have been discovered. There is partial blending of termination and root in some Kalmuck dialects, and in Tamil the derivative *tûkham*, "sleep," has not retained the proper form of its root *tûngā*, while in Turkish still further advances towards inflectional forms have been made.

STRANGE WHIST HAND.

By Richard A. Proctor.

I OBSERVE that many English papers contain an account of a case in which the dealer at whist held all the trumps—and all repeat the mistake of asserting that according to Professor Pole the chance of such an event is but one in 639,013,559,600. I feel sure Professor Pole never fell into such a mistake. The chance is really one in 158,753,389,900; but the *à priorie* probability that any player will hold thirteen cards *of a named suit* is that quoted from some misunderstood statement of Professor Pole's. The subject is dealt with fully at pp. 190, and 194–197, in my "How to Play Whist," under the title "Whist Whittlings."

It is also a mistake to suppose that because there is but one case among 158,753,389,900 possible dealings at whist in which all the trumps go to the dealer, therefore so many trials would be required to give an even chance of such an event. To illustrate the fallacy underlying such a statement—there are two possible events in coin tossing, but it does not require two trials to give an even chance of tossing head. *Half that number suffices.* In articles of mine on Probabilities in former numbers of Knowledge, this point is fully considered, and the proper ratio determined.

I may touch on these points again in "Our Whist Column" later.

METEOR BIRTH OF THE UNIVERSE.

A SOMEWHAT surprising communication (see the last paragraph of this article) has been recently addressed by Mr. J. N. Lockyer to the Royal Society on the subject of the probable origin of the universe from meteoric aggregation. A brief account of the history of this theory from its inception to the present time may serve at once to interest readers and to show in what respect the latest communication on the subject is chiefly remarkable.

In 1848, long before the knowledge respecting meteors had been obtained which has recently thrown such interesting light on their importance in the universe, Dr. Mayer, of Heilbronn, enunciated the theory that the sun's heat is due to the constant indraught of meteoric matter upon the ruling centre of the solar system. This theory involved implicitly the theory that, besides our own sun, all his fellow-suns, the stars, owe their light and heat to meteoric aggregation. Nay, it had to be extended still more widely to include such heat as once pervaded the frames of all the members of the solar system—giant planets, terrestrial planets, aerolites, and satellites—as well as the heat which in like manner pervaded, millions of years ago, the masses of all the orbs circling in system around all the thousands of millions of suns constituting our galaxy. While, also, beyond our own sidereal system all the other similar systems which doubtless pervade the infinitudes of space must presumably (if Mayer's theory were accepted) owe their light and heat—in other words, their life—to meteoric collisions.

Mayer's theory has not secured acceptance in its original form. Supported for a while by Sir W. Thomson, Mr. Joule, and other leading mathematicians and physicists, it was rejected by astronomers, who knew from the motions of the planets that there is not a sufficiency of ungathered material within the solar system to account for more than ten years' emission of solar heat. Yet in another form the theory has been accepted as affording practically the only feasible explanation of the sun's heat. We now regard the heat of the great central luminary as almost wholly due to the action of gravity on the component materials of the sun's mass, that heat being in technical terms the thermal equivalent of the mechanical energy expended in the process of solar contraction. Grant only that the sun's whole mass was produced by a process of meteoric aggregation, and we perceive that this theory of the origin of solar—and therefore of stellar and planetary—heat is simply a development of Dr. Mayer's meteoric theory.

Recognising this, I could not advance as original the theory which I have presented and discussed in the chapter on "Comets and Meteors" in my "Other Worlds than Ours," though much of the evidence was considered there for the first time, and details of the theory as I advanced it were entirely original. I there showed that, whereas the nebular theory of Laplace (which was advanced by that great mathematician merely as a hypothesis) affords no explanation whatever of the strange way in which the masses of the solar system are distributed, the theory of meteoric aggregation gives a very fair account of all the leading features of the system, from the surpassing mass of Jupiter to the insignificant combined mass of the thousands of small planets which travel in a zone next within the orbit of the chief giant of the solar system.

But in the meantime, as also since 1870, when my own first discussion of the meteoric theory of the birth of our solar system appeared, discoveries most interesting and important in character had been and have been in progress. Some of these I have myself discussed at length in these columns; and even if I had not I could not find space to discuss them here. Let it suffice to mention the leading names and the discoveries of chief interest. In America Professor Newton, of Yale College, called special attention to the significance of the periodicity of the November meteors; and through his researches, combined with those of Schiaparelli, Adams, Alexander Herschel, and many others, it has been established that meteor systems play an altogether more important part in the economy of the solar system than had formerly been imagined. The connection between falling-stars, meteors, fire-balls, and aerolites was also satisfactorily demonstrated, a discovery by which the importance of these various orders of bodies in the universe, considered alike with reference to space and to time, was still further indicated. The microscopical studies of Sorby, the English mineralogist, and the chemical studies of Graham, the chemist, showed the structure of meteorites to be akin to what we must regard as the probable structure of the material forming the sun's mass. M. Stanislas Meunier and Daubrée in France indicated at once the varieties of structure, microscopical, chemical, and physical, existing among meteorites, and the identity of each one of these varieties with some variety recognised among terrestrial materials, especially among materials found deep within the crust of the earth. As the oneness of structure existing within the solar system, and indeed within the universe itself, has long ago been recognised, we may regard these researches and the kindred researches of Dewar, Tschermak, and others, as comprising the general theory that all the discrete masses in the universe, from the largest suns to the smallest satellite, are products of meteoric aggregation.

A very important part of the evidence in favour of the theory that all the orbs in the universe were thus formed has always been recognised in the variety of character recognised in the stars as analysed with the spectroscope. Rutherfurd in this country, Secchi, Miller, Huggins, and Vogel in Europe, have shown that the stars may be arranged in classes, indicating varieties of temperature ranging from heat producing only the faintest luminosity to the transcendent heat of the giant suns whose whole masses seem vaporised, if even (as Professor Clarke, of Cincinnati, suggested) the very elements, as we consider them, are not dissociated into the true elements of which they are in reality compounded. This, of course, is what we should expect to follow from the immense range of variety in regard to mass existing in the universe of suns. If these orbs owe their heat to the combined processes of meteoric aggregation and contraction, it must necessarily follow that the larger masses will be the hotter, not only as pervaded primarily by a more intense heat, but as parting more slowly with their heat than smaller masses. (They would give out more heat absolutely, moment by moment, but less relatively to the totality of heat pervading their orbs.)

Thus the theory of meteoric aggregation as suggesting the true method of cosmogonic evolution has long had a great mass of evidence, very varied in character, in its favour. On the other hand, it is open to none of those physical objections which oppose themselves persistently and with overwhelming weight against the nebular theory of Laplace. It requires us to believe in no such unthinkable impossibility as a vast disc of infinitely tenuous vapour presenting all the characteristics of a practically infinite rigidity. This indeed is the merest beginning of the difficulties besetting Laplace's hypothesis—difficulties not recognisable in his day, though he seems to have felt something of their force when he remarked that he presented the hypothesis "avec la défiance que doit inspirer tout ce qui n'est point un résultat de l'observation ou du calcul."

What the great master of mathematical astronomy thus advanced with caution, and even with mistrust, is by the less informed in our time urged with confidence amounting to daring. "Fools rush in"—"the proverb is something musty."

The theory of the meteoric origin of the universe is interesting and attractive, if not in some aspects imposing and almost awful. It has been so long before the scientific world that Mr. Lockyer's manner of advancing it as a new cosmogony must be regarded as awfully imposing in another sense. We may, however, regard Mr. Lockyer's adoption of the theory (like his former absorption of Professor Clarke's fine theory of the probably compound nature of the so-called elements) as indicating the approaching acceptance of the theory by the public at large as well as by the students of science.

THE AMERICAN TROTTING-HORSE.

PROFESSOR WILLIAM H. BREWER, in a paper on the "Evolution of the American Trotting-Horse," shows that the trotter is an American product, and that it is still in process of evolution. He gives a column of figures to show the speed that has been attained in this new form of motion, from a speed of three minutes in 1818 down to two minutes ten and a quarter seconds in 1881. The materials for a curve are offered to mathematicians, and Professor Francis E. Nipher ("American Journal of Science and Arts," vol. xxvi., p. 378), in a mathematical article on the subject, shows that a definite time of ninety-one seconds will ultimately be attained by the American trotter! Mr. W. H. Pickering ("St. Louis Academy of Sciences," May 7, 1883; also "American Journal of Science and Arts," vol. xxvi., p. 20), however, urges some objections to the deductions of Professor Nipher.—*Popular Science Monthly.*

OYSTER PROTECTION.

THE great problem of food-supply has led to legislative enactments for the purposes of regulating the trapping and netting of game and fish. State and Government grants have been made for fish commissions; but, unless the public are clearly educated in the rudiments of zoological science and the principles of natural selection, appropriations will come tardily and in limited amounts. Dr. W. K. Brooks, in his report to the State of Maryland as one of the oyster commissioners, after showing the absurd way in which the problem of oyster-protection has been dealt with, and strenuously urging the necessity of oyster-culture, calls attention to the fact that "civilised races have long recognised the fact that the true remedy is not to limit the demand, but rather to increase the supply of food, by rearing domestic sheep and cattle and poultry in place of wild deer and buffaloes and turkeys, and by cultivating the ground instead of searching for natural fruits and seeds of the forests and swamps." Mr. Ernest Ingersoll, author of the "Report on the Oyster Industry," tenth United States census, has, in an address before the Geographical Society of New York, a striking sketch of the effect of the white man on the wild animals of North America, showing that, had the Indians remained in possession, little if any change would have taken place. The Indian, like the predaceous animals, hunts only for food, and shows even in this habit a wholesome self-restraint, never killing wantonly. He called attention to the survival of a number of small birds about the dwellings of man as the result of favourable conditions, such as a constant supply of food, &c. He shows that the contact of man in the main has been disastrous. His remarks on the oyster are timely; he shows its extermination along the coast by man's agency. "Hardly more than a century has elapsed since men believed that the oyster-beds of New York were inexhaustible, and that a small measure of legal protection, feebly maintained, was quite enough to sustain them against any chance of decay. So they thought in Massachusetts, where the oysters have not only disappeared but have been forgotten. So they think now in Maryland and Virginia, where their fond expectations are destined to equal downfall."—Professor E. S. Morse, in the *Popular Science Monthly.*

THE ANCIENT HISTORY OF THE MAORI.*

MAORI means "native," but the Maori are not the aboriginal dwellers in New Zealand. As near as the traditions which recount the generations of chiefs enable us to reckon, between four and five centuries have elapsed since the immigration from Hawaiki, by which Meinicke says is meant the mythical land of origin of the whole Polynesian race, and not any particular island, although the affinities of the Maori language point to Raratonga. These traditions agree as to the discovery of New Zealand by Kupe, a native of Hawaiki, who formed an expedition of thirteen canoes and ventured across the ocean, and to those canoes the several tribal divisions appear to correspond.

The Malayo-Polynesian origin of the Maori is beyond question, the differences now existing between them and kindred races of the Pacific being due to intermingling with the aborigines, who were of the lower Papuan type, and markedly inferior both in bodily and mental capacity to their conquerors. These have in their turn, not without a fierce struggle, succumbed to the British arms; their decay set in fifty years ago, and their ultimate extinction is only a question of time, so that the task which Mr. White, following in the wake of Sir George Grey, Taylor, Buller, Bastian, and others, has set himself in collecting traditions of no small value, however adulterated and fragmentary as some of them may be, will secure him the gratitude of anthropologists. His book is for students, and they alone can rightly assess the worth of his labours, but the material gathered will filter through them to the general reader, to whom meanwhile some idea of the contents of this volume may be acceptable. The task undertaken in it and in the volumes which are to follow is "no less than to give the Maori traditions of his race as they relate to the creation of the world, the origin of its animal and vegetable life, the ancient wars in the home of his ancestors, the migrations and perils and arrivals of the several canoes in New Zealand, the people they found here, and the territory they respectively occupied; the names given to the mountains, rivers, headlands, and their meaning; the tales of folk-lore, of fairies, ghosts, and spirits, of the monsters of the earth and sky; his traditions relating to the art of tattooing, and the ceremonies connected with births, marriages, deaths,

* "The Ancient History of the Maori." Vol. I.: Taki-Tumu Migration. By John White. (Wellington: Government Press; London: Colonial Booksellers' Agency.)

and tapu,* and the songs and proverbs of his people," the text being given as well as the translation.

Such were the themes on which, sitting under a shady tree, the priests of the old faith discoursed to Mr. White, daring "to disclose some of their sacred lore," but leaving blanks now and then which no logic or persuasion could induce them to fill. "The parts I have not related," said one, "are so sacred that I withhold them in dread of sudden death." "I cannot give some of our sacred history," said another, "as not an old priest now remains alive who has the power to perform the ceremonies to save me from the penalty of divulging the sacred words of the gods." The extreme care with which the ancient legends were guarded so as to secure their unimpaired transmission, the existence of an hereditary caste which was the vehicle of the sacred oracles, are among the many evidences of a highly-organised social state, which, however, existed side by side with insatiate cannibalism. The chapter in which Mr. White describes the Whare-Kura, or sacred school in which the eldest sons of the priests were taught mythology and history, as also the rites and incantations of the craft, is full of interest. Besides this school of divinity, there were schools of astronomy, in which the study of omens to be drawn from the movements of the heavenly bodies was practised, and schools of agriculture and manufactures, all of which were open to every class. In the Taki-Tumu traditions, which this volume embraces, Maui, the great culture-hero, the ancestral fisherman who in many a Polynesian myth hooks up the islands from the ocean, is by no means prominent. We have details of the descendants of polygamous gods which rival the genealogical chapters of Scripture in their dryness; but these are followed by many variants of the wide-spread myth of the separation of earth and sky, the substance of which, old at its base but new in much of its superstructure, is as follows. Rangi (heaven) and Papa (earth) were lying together, and all between them were vines and creepers, tender plants, and red water. All was dark, and their children were born therein, but having seen a glimmer of light in the armpit of Rangi, they resolved to separate their parents. However much the myths differ in detail, they agree in assigning this task to Tane. Having sundered apart his father and mother, he propped up his father, but not liking to see the nakedness of the pair, he caught stars and threw them heavenward "to beautify Rangi, that he might be comely," and then went sunwards to bring trees and plants wherewith to clothe Papa. But the love of the parted ones was unabated; the tears of Papa are carried to Rangi as mist and dew, and the sighs of Rangi are borne on the west wind to Papa, "tickling his ears"; in another myth "he sighs for her in the winter, and this is the origin of ice." The dualism of Christian and other theologies peeps out in the myth that after Tane went to heaven, Tu and Roko destroyed the creatures which he had gathered for food, and then, following him, fought a battle on the borders of heaven, when Tu was slain and Roko cast down, like Satan and his wicked angels. And possibly we have some mixture of Eastern and Oceanian legend in the creation of man out of red clay, and of woman from a sloppy mixture which Tane makes in human shape, and then infuses life into it by processes which cannot well be detailed here. Neither are the traditions without a deluge, which Ta-whaki caused by stamping on the floor of the heaven until it cracked, when torrents of water flowed down and covered the earth. When he died, the green parrots took some of his blood and stained their feathers with it, hence the red colour of those birds to this day. Parallels and resemblances are not evidence of borrowings; the same explanations of like phenomena are often given by races at corresponding levels of culture. But, in the cases before us, we know how probable it is that alien elements have been assimilated, or that they have become confused with indigenous elements in the minds of chiefs who, as Mr. White remarks, "would have given the whole Maori history," both true and legendary, "but, unfortunately for us, these men were born too late; that is, their education began after the Whare-Kura and its rites had been neglected."

The lament or incantation which heads each chapter evidences not only the grace and fulness of the Maori language as a vehicle of poetic feeling, but also the truly astounding aptitude of the Maori mind for abstract thought. Remembering that the idea of a Supreme Being did not exist among the tribes, we, however, need very satisfactory proof that the subtle speculations embodied in the theory of Aeons, beginning with the age of thought and ending with the age of gods and men, and that such definitions as those which are given in this volume, *e.g.* of *Tua* as meaning "Behind all matter," and "Behind that which is most distant," are the genuine equivalents of Maori thought, and not the unconscious gloss of philosophic interpreters. How easy it is to make a serious mistake in the New Zealand tongue the following story, which is cited from Mr. Buller's work, shows:—

> I knew a missionary who, in the early days, had a lesson in *Maori* in not the most pleasant way. It was expedient to give an occasional present to the chiefs in order to secure their good offices, for the lives of missionaries and their families hung upon their caprice. One day the said missionary was giving a small three-legged iron pot to an old chieftain, who, instead of being pleased with it, flew into a great rage, much to the surprise, and somewhat to the terror, of the donor. The cause of this was, he had said, "Mou tenei," whereas he ought to have said, "Mau tenei." Both phrases have, in English, the same meaning, "This is for you;" but, in Maori, there was an important distinction. By the latter form he would have been understood to say, "This is an iron pot for you to do with as you please;" but, by the unfortunate, but ignorant use of the other form, he was heard to say—what he never intended to say—"This is an iron pot for you *to be cooked in*." Hence the fury of the insulted chief.

* *I.e.* tabu, or taboo, as we commonly spell it, signifying the setting of something apart from human contact, investing it with an inviolate or sacred character. We have given the word another meaning, applying it to forbidden subjects, as "tabooing" a conversation.

ROYAL VICTORIA HALL.

(*To the Editor of* Knowledge.)

"ELECTRIC BELLS" formed the subject of a very interesting lecture given at this hall on Tuesday last by Prof. Sylvanus Thompson, who, instead of travelling hurriedly over a large space of ground, confined himself to explaining thoroughly and clearly this small department of electric science.

Ringing one of the many bells displayed on the stage, he inquired where the power was to be found which rang the bell? Imagine an intelligent savage investigating one of our common house-bells, with a crank to convert a perpendicular into a horizontal pull, tracing back the wires till he found the man at the other end pulling them. In like manner we must trace out the less obvious force at work in the ringing of an electric bell. It is no case of pulling, for the wires hang slack. We find one of the wires is connected with two bobbins of coiled wire, which, when the bell is ringing, constantly pull and let go a piece of iron connected with the clapper of the bell. The other wire is connected with this piece of iron, passes thence to an electric battery,

and on to the button which we press when we want to ring the bell. By pressing the button we make metallic communication between the free ends of the wires, so that a current can pass from the battery along them; and this current acts on something contained in the wire bobbins. That something is a core of soft iron, which, while the current passes along the wire which surrounds it, becomes strongly magnetic, and attracts the iron keeper connected with the clapper. But, by a very ingenious contrivance, at the moment the iron is attracted the metallic connection is broken and the current ceases. The iron core thereupon ceases to attract the keeper, and the current is re-established, a jerk being given to the clapper each time this happens.

A number of experiments were shown, illustrating both permanent and induced magnetism; and a variety of forms of electric bell were exhibited, from very sweet-toned church bells of a small size to a contrivance intended to wake up servants, which, when once the button is pushed, goes on ringing incessantly till the tormented servant goes to the bell and pulls a handle. Dr. Thompson then went on to inquire where the power comes from to produce these results, for we can never have results without a cause. There is no such thing as "perpetual motion." Wherever we have power, something must be spent to produce it. Here, it is clear, the power starts from the battery. What is used up there? In ordinary steam-engines we burn coal; in a gun the fuel is gunpowder; in a battery it is zinc. Zinc is combustible in air, though not freely so, and in a battery it is burnt in acid, the combustion going on while the current passes and the bell rings, but at no other time.

There are methods of obtaining a current without a battery; for instance, by turning a handle, and causing a coil of wire to rotate in presence of a permanent magnet. But the same principle holds with all. Something is used up to obtain the power; in this case the man who turns the handle plays the part of engine, and the food which he has eaten is consumed to do the work.

Dr. Thompson, in the course of his lecture, spoke of the large extent to which electric power is used in New England, as many as 200 shops in one town being supplied with it, from wires laid under the streets, as our gaspipes are laid. But for vested interests, he said, the same thing might be done in London, and power supplied to workshops with much economy both of space and money.

The lectures announced after Easter are—April 10, Dr. W. H. Halliburton, "Digestion, including Some Account of Plants that Eat Meat;" April 17, Professor George Henslow, "Movements of Plants;" April 24, Mr. W. P. Bloxam, "Soap-making."

C. A. Martineau.

1 Clifton Place, Sussex Square, W.C.

Gossip.

By Richard A. Proctor.

I deem it desirable to inform the readers of Knowledge that the delay in the issue of Part I. of my "Old and New Astronomy" has occurred through no fault of mine—nay, it has in reality been caused by a circumstance which should indicate the zeal with which I am striving to make this work (presenting the product of a quarter of a century's labour) as complete as possible.

* * *

Finding there was time, I asked Messrs. Spottiswoode to send me yet another revise, after the part had been already thrice revised by myself, and once by my friend Captain Noble. I thought no harm could come, and some slight good might come from my reading it yet another time. Unluckily Messrs. Longmans, hearing from the printers that a last revise had yet to be sent out, supposed there was some risk of the issue of Part II. being delayed, and very prudently (on that—mistaken—view of the case) ordered the postponement of the issue of Part I., lest there should be any breach of continuity in the issue of parts.

* * *

The original delay (from January 1 to March 1) was not my doing, but as I was disabled for two months by a serious accident the delay occurred happily, for I think the issue must have been interrupted had Part I. appeared on January 1.

* * *

The New York papers of February 21 announce the death of a man named Romayne Dillon, who, though an utterly worthless ruffian considered in himself, afforded an interesting illustration of the inefficiency of American justice, where such trifling offences as murder and brutal assault are concerned—that murderous form of justice called lynch-law being the pleasing product of this inefficiency of normal justice. As I have for twelve years or so regarded this man as one who had had his pistol ready for myself—all unknowing of his cheerful purpose—I take some personal interest in his case.

* * *

During the last fortnight of December 1875, I was a guest (most of the time) at the Westminster Hotel, Union Square, New York, my customary stopping-place when in that city. I used often to pace up and down the ground-floor corridors, where, as I supposed, no guests had rooms, finding a sense of relief in this peripatetic habit from the monotony and solitude of hotel life in America for those of domestic tastes and proclivities. I noticed occasionally, but did not note, a kind of subdued growling (like old Bill Barley "in the beam") as I passed a particular door. I had no idea that this growling was in reality exceedingly portentous, and, as I have every reason to think, personally threatening.

* * *

On the evening of December 31, when I was in the reading room, I heard a report which, in my inexperience, I regarded as due to the fall of some metallic substance on the marble pavement of "my" corridor. But other readers, "being acquainted with the [sound] before," knew it meant shooting, and in a second or two every reader was in the corridor. Here we found an unfortunate fellow—John Dilliber, his name was—sitting against the wall supported by one of the waiters. He had been shot, but the man who had shot him had gone back to his room.

* * *

Dilliber made the following statement while he was waiting for the elevator: "I don't know why the man shot me. He came out in his shirt-sleeves while I was walking up and down the corridor, and asked what the devil I was prowling about there for. I told him I had as much right as any other guest to walk there; on which he whipped out a pistol and shot me."

* * *

So soon as Dilliber had been put into the elevator and carried up to his floor, we went round to his assailant's room. We found the man, Romayne Dillon, who had shot and mortally wounded an inoffensive stranger, in the hands of two men, waiting to be handed over to the police. He simply gave as his reason for shooting Dilliber, that "the fellow had been prowling round his door for days"—though, as a matter of fact, Dilliber had arrived only the day before.

On the trial claim was made that Dillon was a monomaniac, with the idea that enemies were constantly spying upon him. But it was pretty generally known that his monomania was simply a brutal and ferocious temper, which had already brought him into trouble for murderous assaults. He was no more mad than the judge who tried him.

* * *

However, he found his way, as other sane but murderous ruffians have done in America before and since, into a lunatic asylum instead of the appropriate halter, and, like others of his kind, having money to back pretended madness, he found his way out again. When I returned to America in 1879 he had already been more than two years at large, and he was then, though an escaped criminal lunatic, living comfortably and openly at the Fifth Avenue Hotel. He remained free during the rest of his life to kill anyone else who might annoy him; and he did not die a natural death (for a murderer), but in his bed, towards the end of February last.

* * *

Another ruffian of a characteristic kind died a week or two before the murderer Dillon. I was introduced a year ago to a young Englishman (a Marlborough boy he had been) who wore an eye-shade; and I presently learned that the evening before a "big old brute"—a man weighing some 15 stone—had forced a quarrel on the slight and rather small young Englishman (all these rowdies are cowards at heart), receiving a straight-hander between the eyes which "propped" him for the moment: but going in for the clutching, rough-and-tumble business, in which, thank God, our Englishmen are not often proficient—and only failing in his attempt to gouge an eye out because hauled off by two other English young men who were there. I saw the brute next day at the railway-station, and wondered that he had been let live so long in a country where, if brutal outrages are too frequent, irregular justice is also too frequently inflicted.

* * *

This ruffian, unlike Dillon, died a natural death, being shot in a quarrel. Unfortunately the man who shot him who was as cowardly a ruffian as himself (but chanced to be a trifle quicker "on the draw"), did not also get his quietus. It often happens that the community has to rejoice in the simultaneous extinction of two ruffians of this kind: and "oh! 'tis the sport to see" the murderer killed by his murderous mate. However, it did not happen so—more's the pity!—on this occasion.

* * *

The English reader must not imagine that life is unsafe in America for those who avoid the spots where ruffians most do congregate. Dillon's villainous temper might be met with in England or on the Continent as frequently as in America; and in his case it was only the escape of the criminal which was characteristic of American ways. Ruffians of the other type are only dangerous for those who either go out of their way to enter low drinking-shops and gambling dens, or for those who enter too readily into discussion with low-looking brutes in more respectable bars.

* * *

American newspapers give unfair ideas of American ways in this respect: for they not only exaggerate the brutal ruffianism of the rowdy, but they picture all their leading men in turn (Democrats in Republican and Republicans in Democrat papers) as swindlers, villains, or otherwise of evil life.

* * *

I had a curious illustration of American editorial ways recently. I had had occasion in the San Francisco *Examiner* to point out that a certain American "professor" is a fraud and a humbug. I gave documentary evidence of falsehood and malice anonymously perpetrated, apologised for by further falsehood (still anonymous) when corrected, and brought home to the real offender a year or two later by unmistakable evidence. This man had obtained high position in the chief national observatory of the United States, where he had "discovered" an impossible third satellite of Mars, and had been otherwise seriously discredited, but whence—unfortunately for science—he has passed to the chief command of a private observatory still more important on account of the telescopic power it will command.

* * *

I had occasion to point out that an honorary distinction conferred by the Royal Astronomical Society on this "scientistic adventurer" was really conferred on him only because he was "taken on trust" on the strength of official position unwisely given him, not for anything he had done, since he has, in fact, done practically nothing. I further went on to express my belief that had I chosen to communicate to members of the Astronomical Society's Council (at that time) the particulars of this "professor's" personal wrong-doing, his name would have been rejected with contempt.

* * *

So far so good. My letters were duly inserted, and, though the "professor" repeated his untruths (with ample opportunity of assuring himself, had he ever doubted it, that they *were* untruths) he was silent in the presence of my final evidence, and manifestly regretted that he had drawn me from the silence, contemptuous though it was, which I had long maintained.

* * *

But a monthly magazine of science—the *Sidereal Messenger*—chanced, unfortunately for him, to mention the thonging which it had been my unpleasant duty to inflict, and the "professor," believing, doubtless, that I should not be apt to see this magazine, for, though excellent, it is published in a rather out-of-the-way place (Northfield, Minnesota), repeated his untruths there. I saw them, however, and met them as before, repeating my remark about the fellow's election to honorary distinction in a society which is honourable as well as scientific. But I omitted to say, as I had in the *Examiner* (which I supposed the editor had seen), that it was by silence only that I had helped the "professor's" election. It should have been unnecessary, in any case, to explain that I had not helped by any positive assistance the election of a man whom I had already described as quite unworthy of the distinction conferred upon him.

* * *

The "professor" craftily took advantage of this omission, quoted the sentence (without the context) in an appeal to certain members of the Council of the Astronomical Society to contradict it, and obtained from two of them (personally unknown to me), Messrs. Knobel and Maunder, the manifestly correct statement that I had never assisted his election by any overt act—and could not have done so, not being on the council at the time. (I resigned in 1873, and have never of my own will allowed my name to be on the council lists since.) The editor of the *Sidereal Messenger*, having presumably forgotten what I implied in my letters to him, and said *totidem verbis* in my letters to the San Francisco *Examiner*, inserts Mr. Knobel's letter, and quotes Mr. Maunder's—as if these letters had any bearing whatever on my real statement.

* * *

In the meantime—it is this which seems characteristic of American journalistic notions—it seems never to occur to the editor either of the *Sidereal Messenger* or of the San Francisco *Examiner*, that a body of honourable gentlemen can be as certainly expected not to elect to any honorary distinction a man proved guilty of falsehood, chicanery, and malice, as (on the other hand) an average body of American politicians would be to elect any scoundrel who could in adequate degree make it worth their while. The editor of the *Sidereal Messenger* actually asks *me*—an Englishman—how I could feel certain that the Council of the Astronomical Society would reject a man with contempt who had been convicted of unworthy conduct!

* * *

A correspondent obligingly sends the following in regard to the question raised in Gossip for February :—

If it interests your readers, or your "polite" correspondent,—Logan Mitchell, in his "Mythology Revealed," published by Trübner, says, page 72:—"'The Egyptians,' says Plutarch, 'inserted nothing into their worship without a reason, nothing merely fabulous, nothing superstitious, as many suppose; but their institutions have either a reference to morals or to something useful in life, and many of them bear a beautiful resemblance of some appearance in nature.' Chæremon, the Egyptian philosopher, says:—'What is said of Osiris and Isis and all the sacred fables may be resolved into the stars, their occultations and risings, into the course of the sun through the zodiac or the nocturnal and diurnal hemispheres.' Porphyry corroborates the above thus:—'The learned Egyptians admit of no other gods except what are called the planets, the gods which give completion to the zodiac, and such as rise together with these, and likewise the sections of the zodiac into decans."

"According to Eratosthenes, the celestial Virgin was supposed to be Isis, that is, the symbol of the returning year. It was in honour of this goddess that the Egyptians celebrated the famous festival of light, which was imitated by the Christians in their feast of Candlemas. From the Egyptians the Romans took their solar festivals, in honour of the birth of the god of light (the sun), celebrated on December 25, at which time, says Servius, the sun may, properly speaking, be said to be new, or have a new birth. Hence the Christmas of the Christians, which had also been, previously, a Druidical festival in honour of the solar god's birth; hence the evergreen emblems—the holly, the mistletoe, &c., all sacred among the Druids thousands of years before Christ."

Ib., page 86. "The 'star in the east' (a sign containing more than a hundred stars), mentioned in Matthew, was no other than this zodiacal sign of the celestial virgin, which arose on the eastern horizon precisely at the time at which we fix the birth of Jesus Christ—viz., December 25, when the sun had risen one degree above the solstitial point,* which answers to a moment to the births of the Egyptian Osiris, the Grecian Bacchus, and the Mithra of the Persians. These mystic births are manifestly identical, being metaphorical of the sun's annual birth at the winter solstice, after which he gradually becomes, not only figuratively, but positively the Saviour of the world. The resemblance, or rather the sameness, of every circumstance relating to Mithras, the Mediator of the Persians, and those connected with the Saviour, or Mediator of the Christians, is so apparent that no rational man can doubt, or hesitate a moment, in pronouncing the latter to be a counterpart of the former.

"Zoroaster taught the Magi that this celestial birth would be announced by the rising of this star, or constellation of the Virgo, in the middle of which would appear the figure of a young woman, suckling an infant child, called Jesus by some nations, and Christ or Christos in Greek. This was the goddess of the year nursing the god of day."

* * *

Mr. Francis Ram sends me a long letter about whist, maintaining his position that scientific whist is no more effective than "bumble-puppy." I have no space for letters about scientific whist from a writer who professes to know nothing about it. If he will not believe my assurances (as one who *knows*) that scientific whist is an entirely different game from what he knows as whist, I cannot help it. All I can do is to repeat my statement. I will not strive to show why scientific whist, played by two partners who understand its principles, is invariably successful (in every spell of play long enough to eliminate the effects of chance). The case is so, to my *knowledge*; and, were it otherwise, scientific whist is a game worth playing, an admirable recreation for the tired worker. The game Mr. Ram supposes to be whist is not worth sitting down to. "Double dummy" is a finer game in the scientific sense than the best whist played by four. But it is too difficult to be called recreation.

* * *

A correspondent asks me about my treatment of the function $\sin^{-1}x$ in my little book, "Easy Lessons in the Differential Calculus," under the impression that $\sin^{-1}x$ is the same as $(\sin x)^{-1}$. This is not the case, though $\sin^{2}x$ is the same as $(\sin x)^{2}$. It has been agreed that $\sin^{-1}x$ shall represent "the angle whose sine is x."

* * *

The same correspondent calls my attention, however, to a real, though easily detected erratum. Near the top of page 34 in that little book $\sin^{-1}x$ appears instead of sin x.

* * *

The chess editor of the *Australasian* calls attention to the fact that in an article on the "Wonders of Blindfold Chess," I not only make mistakes about Paul Morphy's career, but have an illustration representing a chess player blindfolded and feeling for the men. The *Australasian* is good enough to express its belief that I am not responsible for this particular absurdity (I should hope not), but in a tone implying that I *might* be guilty of absurdities as great and greater. Considering that I have played blindfold chess, and have written about my experience in that sort of play, it is rather too patent a bit of spite to write thus of me. This was the sort of thing Mr. Gossip used to do in chess literature; and one might almost imagine he had lighted on the Melbourne chess-world—though, for Melbourne's sake, it is to be hoped not. The chess editor of the *Australasian* when I was in Melbourne was Mr. Wisker, formerly the chess champion of England. I do not know who has held the reins since his death. I fear there has been a noteworthy falling-off. As for the mistakes about Paul Morphy, most probably they are imagined. But in any case they are not mine. They are made, in a sketch of Morphy's chess tour in Europe, by a gentleman who accompanied him most of the time.

* * *

A correspondent asks "if any review has appeared in Knowledge of Mr. Lockyer's meteoric theory?" When we hear of any meteoric theory advanced by Mr. Lockyer we will gladly review it. At present we know only of a meteoric theory suggested, advanced, and maintained by others during the last quarter of a century which some one in the *Times* has endeavoured (in a five-column article) to hand over to Mr. Lockyer! The wicked say the author of the article is Mr. Lockyer himself; but that seems too wild a fancy to be possible. In the Royal Society, however, the method of advancing the meteoric theory recently adopted has been described, publicly, by an eminent physicist as an insult offered to the society by Mr. Lockyer; and Mr. Lockyer himself has been sat upon, after the manner of speaking, almost as severely as if he had really written that Lockyer-adulating article! "'Tis true 'tis pity: pity 'tis 'tis true."

* * *

* This is of course quite wrong. On December 25 now the sun has not risen more than 3 or 4 min. above his solstitial elevation. But December 25 may have been the very day of the solstice in old times.

Reviews.

Biographies of Words and the Home of the Aryas. By F. Max Müller. (Longmans.)—This book is, in the main, a reprint of articles which have appeared in *Good Words*, its enlargement into a fairly-sized volume being effected by long lists of common Aryan terms, and by a series of appendices on the original home of jade, of the Soma, &c. Despite the universally adverse judgment of competent critics upon the cardinal argument of the professor's unwieldy book on the "Science of Thought," viz., that thought is impossible without language, we find that argument restated in the very beginning of the introductory chapter to the present work. "Ephraim is joined to his idols; let him alone." Yet we must again tell the distinguished author that he is confounding symbol with substance, and process with product, that language is not thought, any more than writing is thought, but only the vehicle whereby it is made current. Moreover, cannot the deaf and dumb think? How delightful an expositor Professor Max Müller can be, when we get him away from his obstinate heresies, the following extract shows:—

> There are historical documents which cannot be falsified, though they may be often difficult to interpret—I mean the words of a language. If we wished to know, for instance, who has taught us the game of chess, the name of chess would tell us better than anything else that it came to the West from Persia. In spite of all that has been written to the contrary, chess was originally the game of kings, the game of shahs. This word *shah* became in Old French *eschac*, Italian *scacco*, German *Schach*; while the Old French *eschecs* was further corrupted into *chess*. The more original form *chec* has likewise been preserved, though we little think of it when we draw a cheque, or when we suffer a check, or when we speak of the Chancellor of the Exchequer. The great object of the chess-player is to protect the king; and when the king is in danger the opponent is obliged to say "check"—*i.e. shah*, the king! In the book of the Duchesse, 658, as quoted by Professor Skeat, we read: "Therewith Fortune seyde, '*chek here!*' and '*mate*' in the myd point of the *chekkere*"—*i.e.* Thereupon Fortune said, "*check* here!" and "mate" in the middle of the chessboard. After this the various meanings of check, cheque, or exchequer become easily intelligible, though it is quite true that, if similar changes of meaning, which in our case we can watch by the light of history, had taken place in the dimness of prehistoric ages, it would be difficult to convince the sceptic that *exchequer* or *scaccarium*, the name of the chessboard, was afterwards used for the checkered cloth on which accounts were calculated by means of counters, and that a checkered career was a life with many cross lines, which might end with *check mate*; literally, "the king is dead."

In the chapters on the home and earliest civilisation of the Aryans Professor Max Müller restates and groups the arguments in support of an Asiatic origin, but this is a subject on which, as Penka and others have shown, both the biologist and the anthropologist will have to be taken into counsel, and upon which, while suspending judgment, we watch the balance incline towards the Northern Europe theory.

Social History of the Races of Mankind. Second Division: Oceano-Melanesians. By A. Featherman. (Trübner & Co.)—Mr. Featherman continues his laborious, and, we fear, as yet slenderly appreciated, task of compiling from all available sources materials for generalisation concerning the social stages which mark the relative place of the races of man. His present volume deals with some prominent groups, notably those found in Madagascar and New Zealand, concerning whom the information appears accurate and up to date. Many interesting questions suggest themselves as we turn over these pages; for example, what is the past relation of people so widely sundered as Malagasy and Maori to the great Mongoloid stock on the mainland? Perhaps when Mr. Featherman has finished his gigantic task, he may indicate his general conclusions from the data which his toil has gathered. We think that he has again erred in printing prefatory matter which is not only discursive in character, but which has no relation to the body of his work, and we say this not merely because, so far as we are able to understand it, we disagree with his theory of organic evolution, but because a preface should have connection with that which is to follow it.

Sunlight. By the Author of "The Interior of the Earth." (London: Trübner & Co. 1887.)—When an author states in his preface that "we do not know that the sun is hot," and that by "light we get our expansion of gases as evaporation; on this follows the condensation and fall of the liquid gases as they meet the colder air; then follows the rarefaction of our air by cold pressure, getting rid of all earthy particles till the upper air meets the impalpable cold ether of space without friction"; when, moreover, this author quotes "Nature and the Bible," by a Mr. Jas. Davis, as any authority whatever on a scientific subject; explains (?) gravitation by the action of light, and regards meteorites as "earthy atoms separated from the air by cold pressure and by vegetation," we feel that seriously to criticise such hopeless rubbish would be an insult to our readers' understanding. The writer of this stuff falls foul of Mr. Kinns on p. 144; but as we cannot discover that he has yet quarrelled with the author of "The Mystery of Gravity" (of which a notice appeared on p. 236 of our last volume), we would suggest that he should seek an introduction to that gentleman. Whether he would get much light from Mr. Fraser's heat, or whether, as seems more probable, his light would develop considerable heat in his rival physicist, remains to be seen.

An Introductory Text-book of Zoology. By H. Alleyne Nicholson, M.D., &c. 6th Edition. (Edinburgh and London: William Blackwood & Sons. 1887.)—It may seem almost an act of supererogation to criticise a work which has run into its sixth edition, but for the fact that in the volume now before us Dr. Nicholson has made certain changes in his arrangement of particular groups, and has added notably to the illustrations which appeared in his book in its original form. Whether for the use of schools or for self-instruction, it would not be easy to find an elementary work on systematic zoology to surpass the one before us.

Recollections of Forty Years. By Ferdinand de Lesseps. Translated by C. B. Pitman. (London: Chapman and Hall. 1887.)—From its title-page to the colophon this work of M. de Lesseps is essentially of the French, Frenchy. He is perpetually paraphrasing the familiar line in the poem of Jack Horner, in which that hero "said what a good boy am I;" and poses on almost every page as one of the most daring, indefatigable, and withal, successful men of genius ever produced by the most daring, indefatigable, and successful nation that the world has yet known. But despite this exhibition of almost more than womanly conceit, he has produced a work no small portion of which must possess an abiding interest for all Englishmen, telling us as it does the history of the Suez Canal, and of its ultimate triumph over the blind and ignorant opposition of Lord Palmerston and the British Government. Of Lord Palmerston himself M. de Lesseps says, in describing an interview which they had on the subject of the Canal, "I could not help asking myself now and again whether I was in the presence of a maniac or a statesman;" words which acquire peculiar force in view of Lord Beaconsfield's subsequent acquisition of so large a share in the enterprise whose feasibility his predecessor simply refused even to discuss. But, having said this, we fail to follow the argument of the translator of M. de Lesseps in his preface, where he, in effect, contends that because

Lord Palmerston was utterly wrong in the matter of the Suez Canal, therefore M. de Lesseps must, *ex necessitate*, be right in his views as to the practicability of the Panama one and of the Channel Tunnel. We may well render all honour to the man through whose energy and perseverance so easy and admirable a highway to our own Indian Empire has been opened, without regarding him as infallible. One section of the work (which takes the form of a curiously loose and inconsequent series of chapters, partly autobiographical) has reference to the inception of the Panama Canal, and the glorification of all, and notably of the Frenchmen, engaged in it. The opening portion of volume i. is devoted to a kind of narrative, mainly documentary, of its author's early diplomatic experiences. His account of the scandalous and treacherous assault of the French army upon Rome in 1849 is peculiarly instructive, as showing that *la grande nation* can be guilty of conduct at least as mean, contemptible, and cowardly as that of any of the countries at whose expense he is always so eager to exalt her. The miscellaneous chapters of M. de Lesseps call but for little notice. Essays on Algeria and Tunis and on Abyssinia read like extracts from guide-books, while one on steam seems written to show that to Frenchmen alone are we indebted for its application to machinery and locomotion—a contention which can only excite ridicule and derision in all familiar with the true history of the subject. A chapter on the origin and duties of consuls is the merest "padding." The speech of M. de Lesseps himself and that of M. Renan on the occasion of the admission of the former to the French Academy in 1885 (in which "the butter-boat" was passed in a manner worthy of the concluding meeting of the British Association itself) finish a work which, *malgré* the childish vanity it betrays, forms a real addition to the history of the present century. We began by speaking of its essentially French character. Perhaps no better illustration of this could be found than that of its author's delicate excuse for the lady he calls "Madame Potiphar" (the heroine of Genesis xxxix.) on p. 222.

The Dictionary of National Biography. Vol. XIII. Craik-Damer. (Smith, Elder, & Co.)—The publication of this magnificent work is now being accelerated, and we may hope to witness its completion within a few years. We are not surprised to find that its spirited publishers have been compelled to make a moderate increase in the price; even with this, we fear that their enterprise will have to wait for substantial reward. They are undertaking a task worthy of State subvention, only that subventions are as miasmas upon individual energy.

Management of Accumulators. By Sir David Salomons, Bart., M.A., &c. (London: Whittaker & Co. 1888.)—Most people have heard of the perfect electric light installation at Broomhill, Sir David Salomons's seat, near Tunbridge Wells, and will hence recognise his authority to speak *ex cathedrâ* upon the subject. His practical experience has enabled him to produce a work of real value to those who may be about to introduce electric lighting into their own establishments. His perspicuity of treatment, plainness of language, and abundance of illustration will commend themselves to all seeking aid in their incipient efforts in home lighting by electricity.

A Critique of Kant. By Kuno Fischer. Translated from the German by W. S. Hough. (London: Swan Sonnenschein, Lowrey, & Co. 1888.)—For more than 2,500 years the metaphysical mind, disdaining that verification which lies at the very foundation of scientific method, has beaten the air in vain. Foremost among the self-deceived may be classed the immortal Kant, whose speculations have exercised so preponderating an influence on subsequent German thought. To all who may be interested in watching the process by which a mighty intellect could juggle with words in an attempt to arrive at "the thing as it is" (*Ding an sich*) we would commend the perusal of Mr. Hough's admirable rendering of Fischer's familiar work. The intelligent reader, approaching the subject from the scientific standpoint, will not be long in detecting how and where Kant's exposition of the connection between the noumena he postulates, and the perception of the phenomena he seeks to explain by them, is fallacious. No more instructive example of the emptiness of metaphysical speculation could well be found.

Insect Ways on Summer Days. By Jennett Humphreys. (London: Blackie & Son. 1888).—*Flower-Land.* By Robert Fisher, M.A. (London and Manchester: John Heywood. 1887).—We have classed these two books together as affording, each in its way, an excellent introduction to natural history for children. Miss Humphreys makes each insect tell its own story, and has devised a system of *memoria technica* of the generic and specific names of those so described in the shape of nonsense verses. As for Mr. Fisher's book, no child resident in the country, or who ever has the chance of spending twenty-four hours among heath, field, wood, or hedgerow, ought to be without it. It is a very long time since so admirable a little book for the very beginner in botany has appeared.

Dottings of a Dosser: Revelations of the Inner Life of Low London Lodging-houses, by Howard J. Goldsmid (T. Fisher Unwin, 26 Paternoster Square), is a little book calculated to be of the greatest possible value in attracting the eye of the public to the wrongs of an unfortunate class, which has hitherto been neglected by philanthropists. The dosser is a person too poor to afford a settled habitation, who, when he or she can scrape together the necessary fourpence, hires with it a bed for the night in some low lodging-house, and, when the money is not forthcoming, promenades the streets all night, or finds a resting-place on a seat on the embankment or on a doorstep, if the policeman on the beat will permit it. The dosser is below the class of picturesque poor for whom so much has been done of late; he would need a bath and a new suit before he could enter the "People's Palace" at the East End; he and his rags and his dirt have been hitherto beyond the pale of fashionable benevolence. Mr. Goldsmid writes boldly of the wretched squalor into which these poor unfortunates are thrust by the inefficiency of the law respecting common lodging-houses. The quotation on his title-page is from the Common Lodging-houses Act of 1851: "Whereas it would tend greatly to the comfort and welfare of many of Her Majesty's poorer subjects if provision were made for the WELL ORDERING OF COMMON LODGING HOUSES," but his whole experience shows that no such provision has been made. With an admirable courage Mr. Goldsmid has obtained personal evidence of the state of affairs by himself becoming an inmate of a large number of these houses, which may fairly be taken as samples of the rest. He has found them in a rickety and broken-down condition, with improper sanitary arrangements; the kitchens, in which the lodgers sit and cook their scanty meals, filthy in the extreme; the bedrooms still more loathsome, invariably overcrowded, and the beds full of vermin. In some rooms, which can hardly accommodate three persons, the law permits eight to be huddled. Yet these places are periodically inspected, and "we must suppose, therefore, that it is permissible for the proprietors of the 'doss house' to half poison their lodgers, and compel them to inhale an atmosphere which would be regarded as intolerable at any well-regulated sewage wharf." In almost all these houses men and women are herded together without any regard to

morality or even decency, and numbers of poor children grow up in the midst of surroundings which will surely bring them to join the crowded ranks of the criminal classes. The School Board does not reach these children, and a lodger in one of the houses told Mr. Goldsmid that there was not a School Board officer in the metropolis who would "dare to show 'is ugly mug 'ere." The police inspectors whose duty it is to regulate these houses, visit them only during the daytime, when the lodgers have departed, order has been to a certain extent restored, and the fearful odours of the night have gone off; hence they gain no adequate ideas of the real state of affairs, and legislate for what they do not understand. Mr. Goldsmid holds that the administration of the Lodging-houses' Act should be taken out of the hands of the Commissioners of Police, and that a company should be formed to supply clean and decent accommodation for poor lodgers. He suggests that blocks of the artisans' model dwellings, now being erected in all parts of London, should be arranged so that the rent could be paid nightly instead of weekly, that bathing conveniences should be provided, and that plain, wholesome food should be sold ready cooked on the premises at similar prices to those charged in coffee-houses. He believes that such a company should pay a dividend of 10 to 12 per cent., even if giving the best value for the money. The present common lodging-house keepers, he calculates, make about 125 per cent. profit, wrung from their poorer brethren, whom they keep in a horrible condition of filth, squalor, and degradation. We consider Mr. Goldsmid's suggestion a wise one, and recommend it to practical philanthropists. "Dottings of a Dosser" should be very widely circulated.

THE FACE OF THE SKY FOR APRIL.

By F.R.A.S.

THE sun may be watched for the infrequent and insignificant spots which appear on his surface. The zodiacal light may still be seen in the west after sunset at the beginning of the month. The aspect of the night sky is shown on map iv. of "The Stars in their Seasons." Minima of Algol ("The Stars in their Seasons," map xii.) will occur 15 minutes after midnight on the 15th, and at 9h. 4m. P.M. on the 18th, all other minima happening in daylight during April. Mercury is a morning star throughout the month, but rises such a little while before the sun that he is but indifferently placed for the observer—a remark which, *mutatis mutandis*, applies equally to Venus. Mars will be in opposition to the sun on the 6th, and but for the fact that he has South Declination, would be well placed for observation. As at this time his disc subtends an angle of some 18″, a considerable amount of areographical detail may be made out with comparatively moderate optical means. He is situated to the north-east of Spica Virginis ("The Stars in their Seasons," map v.) Jupiter does not south until the early morning, but towards the end of April may be seen before midnight, though he is too close to the horizon to be at all fairly observable. Moreover, his South Declination is so considerable that even when on the meridian his altitude is too small to admit of the employment of a high power in viewing him. By the end of April his angular equatorial diameter will amount to 41·5″. He is travelling from the south-west corner of Ophiuchus towards β Scorpii ("The Stars in their Seasons," map vii). As scarcely any certainly observable phenomena of his satellites will occur before midnight, we need not occupy space with them here. Saturn is travelling rapidly towards the west, and must be looked at as soon as ever it is dark enough. It will be noted that his rings have closed up to an extent such that his north pole is now visible. He is moving towards η Cancri and the Præsepe ("The Stars in their Seasons," map iii.). Uranus will come into opposition to the sun on the 4th, so that he is now in a fairly good position for the observer. He will be found about three diameters of the moon to the west of θ Virginis ("The Stars in their Seasons," map v.), and may be at once distinguished from the surrounding stars by his bluish unmistakable planetary disc, when viewed with adequate power. Neptune has disappeared for the season. The moon enters her last quarter at 41·3m. past noon on the 3rd, and is new at 9h. 7·7m. o'clock in the morning on the 11th. She enters her first quarter 7·8m. before noon on the 19th, and is full at 6h. 22·1m. A.M. on the 26th. High tides may be expected about the last-named date. Three occultations only of fixed stars by the moon will occur at convenient hours during the present month. The first will happen on April 16, when χ^2 Orionis, a star of the 6th magnitude, will disappear at the moon's dark limb at 9h. 27m. P.M., at an angle from her vertex of 139°. It will reappear at her bright limb at 10h. 26m. P.M., at an angle of 300° from her vertex. Then on the 19th, θ Cancri, of the 6th magnitude, will disappear at the dark limb of the moon at 7h. 34m. P.M., at an angle from her vertex of 70°; reappearing at her bright limb at 8h. 45m. P.M., at a vertical angle of 308°. Lastly, on the 22nd, B.A.C. 3837 (also a 6th magnitude star) will disappear at the dark limb at 6h. 9m. P.M., at an angle of 90° from the moon's vertex. The star will reappear at the bright limb of the moon at 7h. 32m. P.M., at an angle from her vertex of 173°. At noon to-day the moon is in Ophiuchus, through which she is travelling until 8h. A.M. on the 2nd, at which hour she passes into Sagittarius. She leaves Sagittarius for Capricornus ("The Seasons Pictured," plate xxi.) at 3h. P.M. on the 4th, and Capricornus in turn for Aquarius at 4h. P.M. on the 6th. Her journey across Aquarius is completed by 9h. P.M. on the 8th, when she enters Pisces ("The Seasons Pictured," plate xxii.). It is 11h. P.M. on the 11th when, in her passage over this great straggling constellation she reaches the northerly prolongation of Cetus, and an hour or two afterwards she has crossed it and emerged in Aries ("The Seasons Pictured," plate xxiii.). By 7h. 30m. P.M., on the 13th she has traversed the constellation last named and passed into Taurus. As she travels through Taurus she arrives at 7h. P.M. on the 16th on the western edge of the northernmost portion of Orion. Exactly twelve hours later (*i.e.* at 7h. A.M. on the 17th), she crosses its eastern boundary and emerges in Gemini. Here she remains until 4h. A.M. on the 19th, when she crosses into Cancer ("The Seasons Pictured," plate xxiv.). She is in Cancer until 6h. P.M. on the 20th, when she enters Leo. Her passage through Leo terminates at 7h. A.M. on the 23rd, at which hour she quits it for Virgo ("The Seasons Pictured," plate xxv.). At 3h. 30m. A.M. on the 26th, her journey over the constellation last named finishes, and she passes into Libra ("The Seasons Pictured," plate xxvi.). As she travels through Libra, she arrives at 8h. P.M. on the 27th at the western boundary of the narrow northern spike of Scorpio, and when she has crossed this by 4 o'clock the next morning, it is to come out in Ophiuchus. She remains in Ophiuchus until 3h. P.M. on the 29th, when, for the second time this month, she enters Sagittarius. There we leave her.

Our Whist Column.

By "Five of Clubs."

MATHEWS ON WHIST.

The Tenace.

(*Continued from* page 96.)

THOUGH "tenace," or the advantage of position,* cannot be reduced to a certainty, as at piquet, and it is often necessary to relinquish it for more certain advantages; still, no man can be a whist-player who does not fully understand it. The principle is simple, but the combinations are various.

If A has ace, queen, and a small card of a suit, of which B has king, knave, and another; if A leads the small card, he retains tenace, and wins two tricks; whereas, if he plays the ace, he gives it up and makes but one. But if B is to lead, he has no tenace; and lead which card he will, he

* The word "tenace" has no connection, as many imagine, with the cards ten and ace in a suit, though it very often happens that the major tenace is actually constituted of these two cards. The word is a substantival form of the French adjective "tenace," *tenacious, holding*, and implies the "hold" which the tenace gives over the suit. "Major tenace," or the first and third cards, gives the stronger hold; but minor tenace gives a good hold too, in each case, though only if the holder of either tenace is led up to—when, with major tenace, two tricks are made, the second best card being held safe, while with minor tenace, one trick is made, the third best card being held safe, wherever it may lie. The second best guarded, if led up to, is as good as the minor tenace.

must make one trick, and can make no more. The study of this easy instance, well considered, will enable the player, with some practice, to adapt it to more apparently intricate situations. The following cases, which happen frequently, will further explain the principles of the tenace:—Y is left with four cards and the lead, viz., the second and fourth trump, and the ace and a small card of a suit not played. Nine trumps are out, A, Y's left-hand adversary, has the first and third trump, king and a small one of the suit of which Y leads the ace: what card should A play? If A keeps his king he cannot possibly win more than two tricks: he should, therefore, play the king; for he thus brings it to an equal chance whether he wins three tricks or two. By placing the cards you will perceive, that if A's partner has a better card that Y's, Y cannot make either of his trumps, which, had B retained the king, he must have done.

Y has three cards of a suit not played (the last remaining) viz., king, queen, and ten; A holds ace, knave, and another: Y leads the king; if A wins it he gives up the tenace, and gets but one trick; whereas, if he does not, he makes his ace and knave by preserving it.

A has ace, knave, and ten of a suit which his partner leads. If he puts on the ace, and his partner has no honour in the suit, he gives up the tenace, and can only win one. He should, therefore, play the ten (particularly if the lead is forced): for by this he probably wins two tricks.

It often happens that with only three cards remaining in his hand, the leader has the worst trump, and ace, queen, or some tenace of another suit. In this case he should lead the trump, to put the lead into an adversary's hand. By these means he preserves the tenace. This, though self-evident on proper consideration, is what good players never think of. Tenace is easily kept against your right-hand, but impossible, without great superiority of skill, against your left-hand adversary.

You should not only endeavour to preserve the tenace, an advantage of position to yourself when it is evident that the winning cards lie between you and an adversary, but you should do all in your power to give it to your partner, when you perceive that the strength in any suit lies between him and your left-hand adversary. In this case bear in mind that when the left-hand adversary or you lead, the tenace is against the adversary, whereas, if your partner has to lead, the tenace is in favour of your adversary.

False Cards.

There is nothing more necessary to be explained to the beginner than what is usually denominated "under-play," as it is a constant engine in the hands of the experienced to use successfully against the inexperienced player.

As an illustration of under-play—You return the lowest of your left-hand adversary's lead, though you have the highest in your hand, with a view to your partner's making the third best, if he has it, and still retaining the commanding card in your hand. For instance, if A, fourth player, has ace, king, and a small one of his left-hand adversary's lead, to under-play, he wins the trick with the ace and returns the small one, which will generally succeed if the leader has not the second and third in his own hand. You will see by this [putting yourself in the position of the player on whom this under-play is tried] that if you lead from a king and others, and your right-hand adversary, after winning with a ten or knave, returns it, you have no chance to make your king but by putting it on [assuming that your right-hand adversary is under-playing; but even if he is not, his return of your lead would show your king probably worthless, as it would indicate shortness in the suit, so that you can lose little by playing the king].

The following is another situation for under-play:—A remains with the first, third, and fourth cards of a suit, of which he has reason to suppose his left-hand adversary has the second guarded: if he leads the fourth, it is often passed, and A makes every trick in the suit. [It is hardly necessary to say that the lead is not the first in the suit.]

[This play is usually right if you are strong in trumps; but if you are weak, it is generally the best play to make your certain tricks as fast as you can, for the adversaries are probably strong in trumps, and therefore weak in some other suit, which probably is your strong one. Even in this case, however, if you are well protected in the other plain suits, the under-play indicated by Mathews is good: for, if successful, it gives you good forcing-power in the suit, which will probably enable you to make the balance of its strength. If you gain but one trick in this way by a long card in the suit, it must be remembered that one trick made by "play" in a hand signifies an important percentage of advantage. This is what weak players constantly overlook, not recognising the effect of good strategy unless three or four long cards in a suit are made against them. The sound player knows that one trick made by play in each hand would give him marked advantage, while one trick lost in each hand by bad play would signify crushing defeat in the long run. So great an advantage, indeed, cannot be expected from even the best play against the worst.]

The term "under-play" is now often, but incorrectly, used for all cases where a false card is played—that is, a card higher or lower than the one which would be played in accordance with normal whist language. The cases above considered are instances of under-play, except that in the detailed illustration of the first case the ace is played fourth hand from ace, king instead of king as usual: this is "over-play," making the following "under-play" more effective, since the original leader of the suit would be apt to place the king anywhere but in your hand. What follows in regard to false cards relates to "over-play."

Though it is certainly more regular to win your adversary's as well as partner's lead with the lowest of a sequence, still I recommend occasional deviations from that maxim: as it is of the greatest advantage to give your partner every information in his suit or your own, so it is often well to deceive your adversaries in their suits. It will now and then deceive your partner also; but if done with judgment, it is, I think, oftener attended with good than bad effect.

There are also other situations where it is highly necessary to deceive the adversary. For instance, Z, last player, has a tierce-major and a small trump; a tierce-major with two others of a second suit: king, and a small one of a third: with queen or knave, and a small one of the fourth suit, of which his adversary leads the ace. It is so very material for Z to get the lead before he is forced, that he should without hesitation throw down the queen or knave as the most likely method to induce his adversary to change his lead. But this mode of play should be reserved for material occasions, and not by its frequency give cause for its being suspected.

[This may be regarded as the earliest suggestion of the signal for trumps. If the adversary should not change suit, Z's partner on the fall of the small card would perceive that Z had played the high card to avoid being forced, and if he himself took the second trick would immediately lead trumps (his best, if short in trumps), precisely as in response to the trump signal of to-day. This way of indicating a wish for a trump lead belonged, however, to whist strategy, and was not, like the modern signal, a merely conventional arrangement, as little belonging to whist strategy as signalling by coughing, sneezing, or kicking under the table would be.]

(*To be concluded.*)

Our Chess Column.

By "Mephisto."

IN the following sprightly game some curious complications arise which are not often seen in actual play:—

White, Mr. E. Delp.	Black, Dr J. W. Hunt.
Gambit Declined.	
1. P to K4	1. P to K4
2. Kt to QB3	2. Kt to QB3
3. P to B4	3. B to B4

Experience has pronounced against this move in consequence of unsatisfactory results following on its adoption in many important match and tournament games. If Black does not intend to accept the Hampe Gambit, his best plan would be to play 2. KKt to B3 instead of 2QKt to B3.

4. Kt to KB3	4. P to Q3
5. B to B4	5. P to QR3

To prevent the exchange of the active Bishop for the QKt by Kt to QR4, which sometimes precedes this move. The second player can hardly afford the time for such a passive move in this opening.

6. Q to K2	
A lost move.	
	6. B to KKt5
7. R to B sq	

A speculative move. If Black replies with 7. Kt to Q5, then might follow 8. B × P (ch), K × B. 9. Kt to K5 (ch) (*a*). K to Ksq (best). 10. Q × B, Kt to KB3 (*a*). White might, in this variation, give up the piece by 9. Kt × KP (ch): in both cases White will obtain an attacking position.

	7. P × P
8. B to Kt3	8. Kt to Q5
9. Q to B4	9. Kt × Kt (ch)
10. R × Kt	

There was no necessity for playing this move. P × Kt was quite safe: for attacking purposes the move was not effective.

	10. Q to R5 (ch)
11. P to Kt3	11. Q × RP.

It seems that both players pay no regard to each other's attack. White certainly seems to have a pull by being now able to go at it first.

12. Q × P (ch)	12. K to Qsq
13. Q to B8 (ch)	13. K to Q2
14. Q × P (ch)	14. K to B3

necessary, as otherwise Q × B with a check.

15. Q × B	15. Kt to R3
16. Q to R4	

Black's last move was simple, but effective. If White had played Q × P, then R to KBsq would compel White to exchange his Queen for two Rooks, when Black would certainly have the better prospects. White cannot gain anything by checking the Black King.

	16. Q to Kt8 (ch)
17. R to Bsq	17. B to B7 (ch)
18. K to K2	18. P to B6 (ch)

A very curious position indeed. Escape is impossible.

19. K × P	19. Q × R
20. Q × Kt	

Black threatened mate with the Rook, and also by a discovered check with the B.

20. B × P (ch)

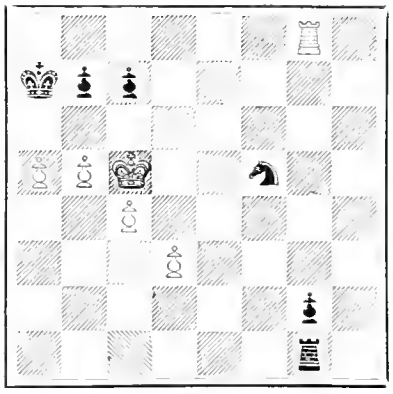
and wins: for if 21. K × B, R to Ktsq (ch), and mate follows.

DRAWING GAMES.

In an end game a good player shows to advantage. Both exactness and ingenuity are necessary to carry a difficult ending to a successful issue. Some players excel in one kind of end play, such as those involving brilliant sacrifices: others, again, are very good at pawn play. Probably the most useful knowledge is possessed by the player who has a knack of drawing games which seem to be lost for him. It is beyond doubt an acquirement peculiar to some players more than others, and an experienced player will always take into his calculation the style of end game play of his opponent, and suit his play accordingly; for to emerge with anything like an even ending against some players may mean to secure victory, whereas with other players no advantage short of a piece will secure an absolute win. The following two endings are ingenious examples how lost games are saved by drawing:—

Dr. Smith.

Black.



White.

Mr. W. Donisthorpe.

Black played

P to Kt3 (ch)

for if now K to Kt4, then R to Kt8 (ch) wins; or if P × P, P × P (ch), K to Q5 or B6, then Kt to K2 (ch) wins. White replied with

K to B6

braving the consequences; thus if Kt to K2 (ch), K × P, Kt × R, White mates in three moves; whereupon Black played

Kt to Q3

Had White now played K × P, Black would have replied with Kt × P (ch), and the white P could not take the Kt, as Black would otherwise obtain a check with his Rook on B8 and Queen his P. White replied by

K to Q5	Kt to B5
K to B6	

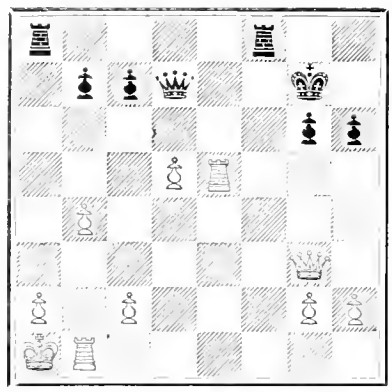
and the game was therefore abandoned as a draw. Black, however, had some chance of winning by playing Kt to Q5 (ch) instead of Q3; for if then K × P, Kt × P (ch), as beforesaid, K to B6, Kt to Q5 (ch), K to Q5, Kt to B5, P P (ch), K × P, P to B5 (ch), K to B2, R to Kt5 or P to B6, then Kt to Q6 (ch), followed by R to Q8, and the Pawn will win. Or if after Kt to Q5 (ch) the White King does not take the Pawn, but retires to Q5, Black might play

	Kt to Q5 (ch)
K to Q5	P × P
K × Kt	P to R5
K to B5	P to R6
P to Kt6 (ch)	K to Kt2

and Black will win.

Mr. W. Donisthorpe.

Black.



White.

Dr. Smith.

White played

R to Q6

whereupon Black drew by	R × P (ch)!
K × R	Q × P (ch)
Q to Kt3	R to Rsq (ch)
K to Kt2	Q to Q5 (ch)
K to Bsq	

If Q to B3, then Black plays R to R7 (ch), winning the Queen.

	Q to Kt8 (ch)
K to Kt2	

and Black drew by perpetual check, as White dare not play his K to Q2.

The following pretty game occurred in a match played in America between Messrs. Lipschütz and Delmar:—

Scotch Gambit.

White. Delmar.	Black. Lipschütz.	White. Delmar.	Black. Lipschütz.
1. P to K4	P to K4	9. P to KR3	Kt × P
2. Kt to KB3	Kt to QB3	10. R to Ksq	Q to B3
3. P to Q4	P × P	11. Q to K2	Castles
4. Kt × P	Kt to B3	12. Q × Kt	Q × P (ch)!
5. Kt × Kt	KtP × Kt	13. K to Rsq	B × P!
6. B to Q3	P to Q4	14. P × B	Q to B6 (ch)
7. P to K5	Kt to Kt5	15. K to R2	B to Q3
8. Castles	B to B1	16. Q × B	Q to B7 (ch)!
		Resigns.	

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THE STAR STORY OF THE FLOOD.

I HAVE made what appears to me an interesting discovery. In drawing the star-maps, which appear in KNOWLEDGE for March and April, I have lighted on peculiarities which have a singular bearing on an ancient record of a universal deluge long regarded as full of difficulties. A series of coincidences which are very strange indeed if they are merely accidental, points, apparently, in the clearest way to an interpretation which is not indeed absolutely new (were it so I might find the evidence less striking), but for which certainly there has hitherto been no such evidence as that which I am about to suggest.

I have had occasion of late, in dealing with the opening chapters of a book on Astronomy (now nearly a quarter of a century in preparation), to consider the aspect of the stellar heavens as seen by Babylonian and Egyptian astronomers. So far as I know, no modern student of astronomy has been at the pains to picture the starry skies as they appeared at particular long-past epochs in the history of astronomy. Here and there cases have occurred where some special star or constellation has been set back (as it were) so many thousands of years, in order to ascertain what position it had in the days of Ptolemy or Hipparchus, or, farther back still, in the time—some 2200 years B.C.—to which the building of the Pyramids of Egypt was first assigned by those who regard the descending passage as a polar pointer, or yet further back to that time—about 3400 years B.C.—when the same star was in view down that descending passage, and when, according to Egyptologists, the dynasty of the Pyramid builders held sway over the land of Egypt. I have myself, accepting that remoter date as unquestionably the true era of Cheops, Chephren, and the rest of the Pyramid builders, noticed many details of interest in the stellar skies of those days. I find, for example, that the ascending passage and the great gallery within the Pyramid, besides commanding (by reflection at a water surface) the pole-star of the period, bore directly on the star Alpha Centauri, remarkable as the nearest of all our sun's fellows in the star depths. The long trenches dug outside the eastern edge of the Pyramid's base (and called by Professor Smyth the azimuth trenches) bore on the bright stars Arcturus and Capella at their rising, and were doubtless associated with the observation of the rising of these stars, so as to be visible just before sunrise—a relation called the heliacal rising of these first-magnitude stars. The Pleiades were at that time exactly on the equator, a much more critical and interesting feature than Professor Smyth had looked for when he sought a date near the year 2200 B.C., and selected one which put the Pleiades on the meridian passing through the sun's place at the spring equinox—for the equator is of all the circles on the celestial sphere the most easily recognised and the most obviously interesting.

But while I had noticed many such points as these, and had indeed been much attracted by their study, I had not been able to find time for what I had long intended—the construction of maps which should show the whole of the starry heavens as they would have appeared at or about that critical time when the astronomy of the ancient Babylonians and Egyptians (as distinguished from the modern Nebuchadnezzars, Pharaohs, and the rest) reached its culmination. No astronomer who studies carefully what is known about ancient astronomy, can fail to recognise in the astronomy of the later Chaldeans the signs of decadence and degeneration. Nor can we wonder that it is so. Clearly in the days of the earlier kingdoms of Babylon and Egypt, astronomy had been regarded as full of material promise. All the ancient astronomers were astrologers; it was the astrological aspect of astronomy alone which had invited them to the laborious and expensive works by which they had hoped to force from the skies the secret of the stars, and to give to their ruling dynasties the power not only of reading but of ruling the celestial orbs. That hope had been in great measure disappointed. Astronomers still from time to time renewed their aspirations, and we find records that kings and rulers put trust in the promises of their astrological magi and diviners; but never again did whole nations contribute as they had done in the days of Cheops and Chephren, and in those of the builders of the Babylonian temple of the planetary spheres, to erect temple-observatories for the study of the movements of the heavenly bodies. The building of the Great Pyramid and (contemporaneously with it) its fellows in the Ghizeh plains, marked the time when astrological astronomy reached its highest phase of development. It was at once the science and the religion of the great Eastern nations of those days. Cities were built to the sun and moon. All the works of human life, from the day when the babe's nativity was cast to the time when the body was to be committed to the tomb, were regulated by the movements of the heavenly bodies, whose influences as deities were supposed potent over all transactions from the most trivial to the most important.

When leisure, or rather the course of my literary labours, gave me the opportunity to construct a planisphere of the ancient skies, I took for my epoch 3400 years B.C., because while that accorded well with the date assigned by Egyptologists to the reign of Cheops, it brought the pole-star, Alpha Draconis, or Thuban, into the direction aimed at by the long descending passage, cut (some four feet square) into the solid rock below the Pyramid, and continued right through the massive stonework to a total distance of more than a hundred yards. It has always seemed to me preposterous to question the astronomical significance of this polar pointer. One might as reasonably question the astronomical use of the monster sundials and other shadow-throwing structures in Delhi, Benares, &c.—as, indeed, non-astronomical persons would most certainly do if we did not chance to have records of the objects with which these masses of stonework were set up, and of the astronomical uses to which they were applied. The men of the Pyramid times may not have made such advances in science as the men of our own day, but they were not wanting in sense. We may be sure they did not make these obviously astronomical passages and galleries merely to symbolise imperfectly for after ages such knowledge as they possessed, but with a very definite purpose. We may confidently accept as obvious the theory, first advanced by Sir John Herschel, that that long passage was a polar pointer, the longest and most massively constructed ever made by man. We can have no doubt that Thuban, the mid star of the Dragon, was the pole-star towards which it

was directed. This leaves us only two dates between which to choose, for the time of the important astronomical era marked by the building of the Great Pyramid—viz. about 2200 B.C., and about 3400 B.C.—unless we care to go back some 27,600 years farther, when again we find a pair of dates, about 31,000 and 32,200 years B.C., when Thuban was rightly situated. We may safely reject all such exceedingly remote dates, however, as Egyptologists agree in assigning to the dynasty of Cheops, Chephren, &c., dates between 3200 and 3600 before Christ.

For the date 3400 B.C., then, I constructed my charts, expecting to obtain interesting and curious results. I hoped in particular to find explanations of references to the stars by poets of later days, who recalled old sayings in ignorance of the fact that the aspect of the heavens had altered since those sayings had been in vogue. For experience shows that there are few subjects in which old ideas retain their influence more tenaciously than they do in regard to the aspects and movements of the heavenly bodies.

The first glance at my maps (when they were completed in such sort that the skies of 5300 years ago were presented before me) served to explain several familiar passages of the classics. For instance, Virgil's well-known lines,

> Candidus auratis aperit quum cornibus annum
> Taurus,

imply as distinctly as possible the idea that the year began (which would mean that the sun crossed the equator at spring) when the sun was on the Bull's horns. But in Virgil's time, the sun was not in the constellation of the Bull at all when the year began (in the old sense of the words). The point where he crosses the equator had passed out of Taurus, over Aries, and had already entered Pisces at that time. The sun in Virgil's age was passing over the Bull's horns in the middle of May, a time which cannot by any astronomical or meteorological artifice be regarded as the opening of the year.* But in my chart for 3400 B.C., the sun was right on the Bull's horns at the beginning of spring.

Another passage in Virgil finds an explanation from the same chart. In his "Pollio," taken from a Sibylline prophecy of venerable but unknown antiquity, we find him saying,

> Jam redit et Virgo, redeunt Saturnia regna,

as if there were some connection between the constellation of the Virgin and the return of the beneficent influence poured forth by the sun in summer. Pope, indeed, in his introduction to his eclogue, "Messiah," goes so far as to draw a parallel between this passage and the well-known passage in Isaiah, "Behold a Virgin shall conceive and bear a son." But without entering into a discussion of the Virgin birth attributed of old to sun-gods, Osiris, Horus, Mithras, Serapis, Adonis, and the rest (and naturally ascribed later to such teachers as Zoroaster, Gautama, Plato, and others), we may at once find an explanation of Virgil's reference when we note that at the time to which all his astronomical passages must be referred, the sun—who was leaving Taurus in spring—was entering Virgo at mid-summer.

I might consider a number of similar matters, many of them of much interest, but that I should thus leave little space for the special discovery which I wish here chiefly to consider.

The celestial equator drawn for the year 3400 B.C. runs along the whole length of Hydra, the great sea-serpent, from his Heart, marked by the star Alphard (or the Solitary, known also as *Cor Hydræ*) to the tip of his tail. The head and neck are reared above the equator, that is, on its northern side, which for Egypt and Babylon would of course be above, and the two small constellations, the Raven and the Cup, which, though undoubtedly very ancient, were as undoubtedly parts of the Sea-serpent as well as independent constellations, rise above the equator, as if the body of the Sea-serpent showed here slightly above the ocean level.

This peculiarity of the starry skies of the time we are considering, recalls the old idea that around the heavens as around the earth is coiled a mighty serpent, associated with the ocean waves surrounding the frame of the earth. In the description of the constellations in the shield of Herakles we find (following Elton's translation) what corresponds closely with this peculiarity:—

> Rounding the utmost verge the ocean flow'd
> As in full swell of waters, and the shield
> All variegated with whole circle bound.

Remembering that the same poem describes the Dragon as "coil'd"—

> . . . full in the central field,
> With eyes oblique retorted that askant
> Cast gleaming fire,

which corresponds precisely with the polar position of the Dragon at the time we are considering, we see that the rounding of the utmost verge by the ocean "swell of waters" may fairly be regarded as extremely significant. It matters not in the least whether we adopt or reject the idea, thrown out by me eighteen years ago, that the original description of both the shield of Herakles and the shield of Achilles (two unquestionably solar heroes) related to the dome of a zodiac temple for the worship of the sun. It suffices that in each case the poem speaks definitely of the constellations. Each shield contained them, so that the object originally described undoubtedly presented the constellations as on a dome or hemisphere, or in a chart, and my sole contention here is that the reference to the Dragon as the polar constellation, and the sea waves as bounding the circuit of the constellations, indicates the period to which the picturing of the constellations belonged. In passing, however, I may remark that the identity of many lines in the two descriptions shows that in each we have part only of what was originally a much longer poem; and, while it is unlikely enough that objects like the constellations would be selected for the adornment of a warrior's shield, and improbable that in a group of songs like those composing the "Iliad," so long a description would be devoted to a mere shield (unless a poem already extant provided convenient material), it is utterly incredible that a poem so long as the original from which both "shields" were derived, should ever have related to such a subject as a mortal warrior's shield, or have been but part of a single book of an epic poem. The shield of Jove himself in the "Iliad" is described in four lines; the poem from which the shields of Herakles and of Achilles

* I may remark here that Chaucer is more careful in this matter, but has been blamed by Tyrwhitt for an error which he had not made. In the prologue to the "Canterbury Tales," he speaks of the time (which he there indicates as in April, and in other places marks as late in April) as that

> When Zephyrus . . . with his swoote breath
> Inspired hath in every holt and heath
> The tender croppes, and the yonge sun
> Hath in the Ram his halfe course y-run.

On this Tyrwhitt remarks that this would place the time of the pilgrimage in the end of March. But Tyrwhitt has confounded the sign with the constellation. Our almanacs speak of the sun entering Aries on the day of the autumnal equinox, meaning the sign, which for convenience still has its "first point" at the place where the sun crosses the equator. But the sun does not really enter the constellation of the Ram till a month later. Chaucer, who seems to have been well versed in the astronomy of his day, says rightly that the sun had run half his course in the Ram towards the end of April.

have been borrowed cannot have been much less than a thousand lines in length.

It was the recognition of the peculiar correspondence between the equator and the long body of the Sea-serpent (ranging past the zodiacal constellations, the Crab, the Lion, the Virgin, and the Scales) which led me to inquire into the position of some of the most remarkable constellations of the earliest known systems of astronomy. Naturally I turned first to the great constellation Argo, which is, or rather was, altogether the most striking of them all.

Let me, however, premise that few even among astronomers seem to understand how in ancient times the constellations were dealt with. It requires a long and careful study of old descriptions and old globes and pictures, to recognise what the constellations really must have been; and modern astronomers, those at least who are chiefly engaged in surveying the heavens, take little interest in inquiries of the sort. Most of them imagine that the constellations have always had about the limits assigned to them in modern charts. And since it is obvious that, as thus defined, the star groupings show for the most part very little resemblance to the various objects after which they are called, it is quietly taken for granted that men in old times called the star groups by names assigned for the most part in quite arbitrary fashion.

Mr. Lang, in his interesting volume "Custom and Myth," has an essay on star myths, which is partly based on the idea that there is no real resemblance in most cases between a constellation and the object after which it is named. "The most eccentric modern fancy," he says, "which can detect what shape it will in clouds, is unable to find any likeness to human or animal forms in the stars." Yet the forms are there in the star-groupings, in some cases so strongly suggested, that once noted they cannot readily be lost. Mr. Lang himself notes the Crown, where the resemblance is obvious when the heavens themselves are studied, and also easy when the modern constellation-maps are considered. The Dolphin is another example where the fitness of the ancient name is easily seen. A case or two of this kind ought to suggest that, in other cases, where the resemblance may not appear so obvious, and where there may be no resemblance at all when the modern constellation is examined, either some important changes have taken place among the stars themselves or else the modern constellation differs greatly from the old one.

Rejecting the former supposition as contrary to the evidence—for though stars have changed in brightness there is no evidence of changes numerous enough to spoil the old constellations—we examine the other. But here at once we find how the difficulty has arisen. The modern constellations not only differ from the ancient ones, but have been formed on an entirely different plan. The old constellations overlapped freely; the modern ones, on account of the special purposes which they are intended to fulfil, fit like the counties in a map of England. The care with which this requirement is now attended to belongs in reality to quite recent times, though probably even in the days of Hipparchus and Eudoxus something of the sort had been attempted. There are clear signs that even long after the Greek lettering of Bayer was adopted, the constellations remained somewhat overlapping. Thus the star which Bayer called Alpha Andromedæ he also called Delta Pegasi, as it formed an essential point in the configuration of both constellations. But as the modern astronomer does not care two straws for the mere configuration of the constellations and cares a great deal about simplicity and uniformity of nomenclature, one of these names had to be given up. Consequently the modern student of the stars looks in vain for Delta Pegasi in the charts. He finds Alpha, Beta, and Gamma, also Epsilon, Zeta, Eta, and so on, nearly to the end of the alphabet; but Delta Pegasi he cannot find. Yet the star which was so named is of the second magnitude. In like manner the constellation Auriga wants the star Gamma, which formerly marked the spot where Auriga overlapped Taurus. The star remains, of course; but it now only has one title, Beta Tauri, instead of being called also Gamma Aurigæ.

In modern charts, showing the constellations, we find lingering traces of the old usage, carelessly though these figures have been dealt with. Thus the Scorpion's claws had been for too long a time and too intricately mixed up with the legs of the Serpent-holder to be readily extricated. By a desperate effort the constellation boundaries have been kept apart, though both Scorpio and Ophiuchus have lost stars in the contest. But the figures showing these two constellations still present one claw of Scorpio amicably twined round one of the Serpent-holder's legs, the other extending behind the southern scale of the Balance. It may be noticed in passing that the Scorpion and the Balance illustrate the change from the ancient method in another way. It is well known that for a time the Balance disappeared from Greek star maps, notwithstanding its importance as a zodiacal sign, and its exceedingly ancient standing. Then the claws of the Scorpion were withdrawn and the Scales resumed their place, many imagining that the Balance then first took its place in the heavens. But this is an altogether mistaken position. They merely resumed the place which they had formerly occupied.

Now when we are no longer limited to the modern constellation outlines, in our search for the star-groupings in which men of old found resemblances to various objects, animate and inanimate, we can readily see where these resemblances were imagined. For instance, whereas the present Lion of the star maps, is an altogther feeble creature, with a nose like a rat, and no tail at all, the ancient Lion, whose head was on Cancer, its mane over Leo Minor, and the tail formed by the group called Berenice's Hair, while his hindpaws fell on the Sextant, and his forepaws over the Sea-serpent's head, was really a magnificent stellar animal, whose form can still be clearly recognised among the stars. So with the Bear: where our maps show his long tail—imagine a long-tailed bear and what the ancients would have thought of our raising such a nondescript to the heavens!—fell really the outline of a portion of his back. A large part of his body covered that ridiculous modern constellation, the Hunting Dogs; his head for a wonder has been left, and most neatly pictures the peculiar head of a bear (though it also served the Egyptians for the head of a hippopotamus), while the long plantigrade paws are also most characteristically indicated. He is chased, this real old Bear recognised by all the nations of antiquity from China to Peru (the long way round), by the Herdsman Bootes, with uplifted arms: so, at least, the old watchers of the stars saw the figure of the Ploughman; but modern astronomers have thought it necessary to deprive him of his right arm, which has been assigned to the constellation Corona. By modern astronomers in this case, I refer to the contemporaries of Hipparchus and Ptolemy. And so with many others of the most interesting of the ancient constellations. They have been separated where they formerly overlapped. Then pieces have been taken off them to form such ridiculous constellations as the Clock, the Painter's Easel, the Pneumatic Pump, the Flying Fish, the Chameleon, the Shield of Sobieski, and a host of other absurdities which discredit the memory of Hevelius, Lacaille, and others who, like them, should have known better.

(To be continued.)

HUNTING ALLIGATORS.*

THE Florida 'gator is a rare "bird" in its way, and a very formidable one, too, at times, but, like all celebrities, is sometimes used as the basis for some stupendous yarns. For instance, in a recent issue, a Newark (N.J.) authority (?) gives the *modus operandi* for catching and killing the saurian, when its skin is wanted. One method was to get the 'gator amused at some side-splitting (New Jersey?) tale, or else tickle him under the fifth rib, and when he opened his huge mouth in an amused grin, to seize the opportunity and thrust a big harpoon through his tongue. The 'gator would then good-naturedly butt himself against the bank until he felt the throes of final dissolution, when he would float up against the wharf, give up the ('gator) ghost and be in readiness to be skinned. Again, the spectacle of "Alligator Platt" riding on a 'gator's back, "geeing and hawing," so as to make a good landing, would make even the most ill-natured and fierce bull saurian that ever infested these waters, split his sides with loud guffaws! It should have been added to this that he trained them and drove them in pairs to plough his orange grove!

The 'gator is beset with dangers from the first, which probably accounts for his somewhat unfriendly disposition. The female finds some secluded sandbank exposed fully to the sun's rays, scoops out a hole two or three feet deep with her fore paws, lines it with old rubbish, grass, &c., and lays a layer of eggs from 25 to 200 at a time. These are carefully covered over to a height of three to four feet with grass, small sticks, &c. From the moment of laying the eggs scores of enemies are in wait. The big sand cranes and eagles are not averse to a good meal of 'gator's eggs, while bears, wild cats, and foxes take them as a great delicacy. Then comes the naturalist and curiosity hunter, and hundreds of eggs are gathered by these insatiable seekers. The old female is very fierce at this time, and lies in wait near by, and has been known to attack men even in the defence of her nest. Finally the young 'gators are hatched by the sun's rays, and the mound seems alive with what looks like young snakes. These young ones are smart and lively from the first. The old bull 'gator, with an idea of the good things of life, has been taking a sly interest in this incubation, and when the young ones get out he is on hand to take a good meal on infant alligator.

Many fights have been witnessed between the female and the male, in the former's defence of her young. The young ones, until they reach a length of a foot, are with the old female all the time. Their great delight is to lie basking on the sunny sand bank, clustered in one big mass. Upon the slightest alarm the old mother utters a hoarse call, opening wide her capacious mouth, and the youngsters scramble in for safety.

Formerly they were plentiful on all the streams and lakes in this State, but the indiscriminate shooting has scared them off into the more inaccessible bayous and lakes. In the lower portion of the State, in the everglades, they are hunted vigorously for their skins. Scores of hunters secure from 1,000 to 1,500 skins annually, and as they receive $1 each for them, they obtain what is to them a princely income.

"Alligator Platt," one of the oldest hunters in that section of the State, lives on Lake Tohopekoliga, and his stories of miraculous escapes from 'gators and bears are thoroughly enjoyed by the tourists who have the good fortune to hear him narrate any of them.

The best and most common mode of hunting them is by flashing their eyes at night, the same as deer stalking. Two generally hunt together in a canoe, one sitting in the stern paddling, the other standing at the bow, with a bull's-eye fastened to his head. They move on cautiously, the one in front coaching the course by slow motions of his hand. Hist! a warning hand is upraised, the motion of the paddle ceases, and the canoe glides on almost imperceptibly, the slight ripple at the bow being the only sound heard. The one with the rifle—a 44-calibre Winchester—slowly raises his weapon, peering expectantly forward, now to one side, then another. Suddenly a gleam is seen ahead like a coal of fire shining through the darkness, and the upraised rifle belches forth a stream of fire. A confused threshing, and, perhaps, a deep bellow follows; then all is still. If wounded the 'gator makes off to deep water, and if dead he sinks at once. The hunters do not stop for their game, unless in shallow water, and the 'gator is killed instantly, but go ahead and search for fresh victims. The next day they begin their look-out for their game. When killed the saurians sink at once, but the gases in the body bring them up in from six to ten hours. Hundreds are undoubtedly lost by being wounded and dying in some inaccessible creek or bayou, but the pot hunters care not. The skins are carefully taken off, and the carcases left for buzzards and other scavengers, though the teeth are generally secured if there is time. No portion is eaten, though some of the hunters delight to thrill the incredulous tourists with tales of living on alligator meat.

Last Christmas a good joke was perpetrated at a leading South Florida fashionable resort. It was a great headquarters for sportsmen, and game of all kinds was abundant on the table. On Christmas day, on the *menu* cards of the table where six jolly characters sat, was "venison" steak. It seemed to please them all greatly, and was called for repeatedly, and the cook was complimented for the fine dish. After dinner, as they were picking their teeth complacently in the reading-room—[such is, alas, the savage custom throughout the States.—R. P.]—the smiling host, a great wag, who never suffered himself to interfere with a good joke, called several of them into the office where a dozen or more others were gathered, and casually inquired regarding the "venison."

"It was remarkably fine," said a well-known Chicago banker; "so juicy and tender. Where was it killed?"

"Yes," interjected a New Yorker, a prominent yachtsman, who also prided himself on his ability to hunt. "It was prime. I shall have to try my luck at his kindred to-morrow."

"I certainly enjoyed it," remarked a Congressman from Ohio, a well-known epicure, too. "You know I always said you ought to give us more of that sort." Others joined in to the same effect, when the host, with a twinkle in his eye, said:

"Well, gentlemen, I am certainly glad you enjoyed that alligator steak. We can now find a good use for those fellows."

A moment they stood spellbound by his words, and then, as the full meaning burst upon them, their faces paled to ashy whiteness and they left for their rooms precipitately, whilst peals of laughter greeted the victims from those in the secret. For some time afterwards it was not safe to mention "venison" to any of the partakers thereof.

Generally, alligators are very timid, and they will seldom attack a man unless wounded and driven to a corner. Still, instances are narrated of old bull 'gators becoming pugnacious and attacking boats. Dogs, pigs, and small animals are seldom safe from their attacks, while cattle and horses have been known to suffer from their assaults. The

* Jacksonville (Fla.) correspondence St. Louis *Globe Democrat*.

big bull 'gators often go across country from one pond to another, sometimes going many miles. Where ponds or lakes are closely connected there is always found a well-beaten track leading from one to the other. Sometimes they are encountered on the road. These journeys are made near nightfall.

Besides their skin, the teeth are valuable, being made into "alligator jewellery"—charms, ear-rings, ring-bangles, &c. The teeth are generally secured by burying the head till it decomposes, and then picking out the teeth—a not very pleasant task. The teeth are then bathed in acids, which thoroughly clean and remove all unpleasant smell.

A full-grown 'gator is from 12 to 18 feet long, and displays a remarkable "openness" when he smiles in his own peculiarly engaging way.

CANALS OR RIVERS ON MARS?

DURING the present approach of Mars, who passed opposition on April 11, careful observations should be made by those who possess large telescopes, or have control of well-provided observatories, on the so-called "canals" of Schiaparelli, and especially on the duplication of the canals. The planet will be more favourably situated than Schiaparelli himself supposes for the investigation of these phenomena. He recognises in the appearance and disappearance of double canals a periodicity depending upon the Martian seasons, having observed that they come into view soon after the vernal equinox of the northern hemisphere, and gradually disappear—that is, fewer and fewer of them are seen—towards northern midsummer; and he has invited astronomers to observe whether similar phenomena are to be noticed after the autumnal equinox of the northern hemisphere—that is, after the vernal equinox of the southern hemisphere. But he does not notice that there is reason to expect a recurrence of the phenomena which have perplexed him (and by which he has perplexed many) as the autumnal equinox of the northern hemisphere approaches—and under more favourable conditions than after the equinox, because most of the "canals" are in the northern hemisphere of Mars.

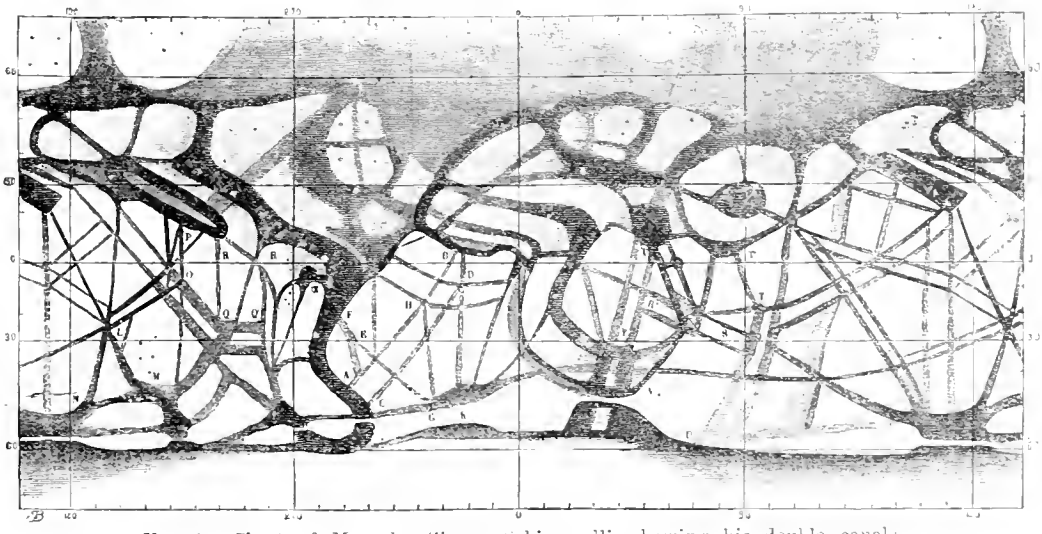


FIG. 1.—Chart of Mars by Signor Schiaparelli, showing his double canals.

Fig. 1 represents Schiaparelli's chart of Mars on a modification of Mercator's projection. A glance at it will serve to show observers of Mars that whatever may be the accuracy of Schiaparelli's observations, he has not correctly delineated the planet's aspect, while it will equally show students of physical geography and believers in the uniformitarian views now prevailing throughout science generally, that the "double canals" have probably no objective existence. Yet we cannot reject Schiaparelli's observations, renewed as they have been by himself at successive oppositions of Mars since the phenomenon was first observed, and confirmed by Celoria, Perrotin, and Trepied.

I suppose Schiaparelli himself has given up the wild notion suggested by him, and accepted by several of the ultra-cautious astronomers of the inductive school (in which rashness and caution strangely interchange places), that the canals and their duplications are the work of Martian inhabitants. For though a purely inductive philosopher (acting on the inductively cautious principle that everything observed is to be accepted precisely as observed, and not to be corrected by any such rash process as deductive analysis) might gladly accept the idea that Martian beings could first construct canals thousands of miles long and twenty or thirty miles wide, and then duplicate these in two years or so of terrestrial time, even inductive caution can scarcely be capable of believing that the second canal of each pair would be destroyed as each Martian summer approached and renewed soon after the next following spring.

The interpretation which, with deductive rashness, I suggested for Schiaparelli's observations soon after they were first announced seems so strikingly confirmed by his later observations and the recognition of a seasonal periodicity in the phenomena, that I venture to recall attention to it now, when it can be tested by observations which may prove even more effective, if not decisive. "Some difference of opinion," said the late Mr. Webb, "may possibly be expected concerning these strange appearances"—a tolerably safe prediction—"and the consequent enfeebling (to say the least of it) of the long-admitted terrestrial analogy may be, to some minds, unacceptable." I have one of those "minds," a mind which obstinately declines to give me the *otium cum dignitate* resulting, so far as I can judge, from the placid acceptance of strange observations as signifying just what they seem to signify, and not at any price to be interpreted according to known laws and established analogies. "But," Mr. Webb went on to say, "the established reputation of the observer"—Schiaparelli—"demands at any rate a respectful attention to his statements." With this opinion

I must express the fullest agreement: *only*, it has always seemed to me that when an observer of established reputation has made a series of striking observations, respectful attention involves careful examination of his work. If I were myself devoted to observation, and unable (as is the case with many of our best observers) to give much time to analysis, I should not be very grateful to those who claimed the acceptance of my observations precisely as they stood, without inquiry into their significance, or such due comparison *inter se* and with observations made by others as would be essential to their satisfactory interpretation. To this I may add that the basis of such analysis should always, in my opinion, be admitted analogies. I know of no theory now accepted as sound which ever had any other foundation.

I regard Schiaparelli's observation as one of the most interesting ever made by the telescopist. At the same time, I consider his "double canals" as having no existence in nature. "But," says the purely inductive philosopher, "he has seen them, and therefore they *must* be objective realities." Hevelius said the same of the star-discs which his telescopes showed him, and became quite angry (for an astronomer) when his measurements of those discs were

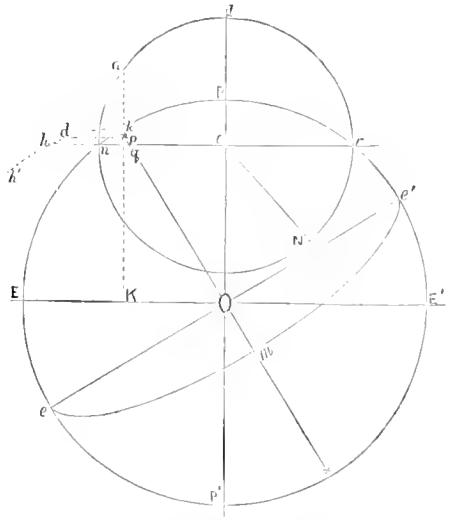


Fig. 2.—Construction for determining the axial pose of Mars on the meridian, May 1, 1881.

looked on with doubt. If his telescope had been a little better he would have seen not only seemingly well-defined and measurable star-discs, but a series of very obvious and unmistakable rings round each star. And probably the more simply inductive philosophers of his time would have been indignant (philosophically, of course) at those who would not admit the enfeebling, to say the least of it, of long-admitted solar analogies, and give such respectful attention to the observations of the eminent astronomer as would have been involved in the supposition that other suns than ours have immense rings round them, so situate through some strange influence that they are none of them foreshortened, but all appear exactly circular.

The interest of Schiaparelli's observations resides (for me) in the circumstance that they indicate the existence of an analogy between Mars and the earth, which, though long suspected, had never before been demonstrated. Unquestionably not duplicate canals on Mars, nor phenomena due to our own atmosphere, the double marks were as unquestionably seen; and we need not be in a hurry to say that "explanation is set at defiance," since there is nothing suggestive of inherent inexplicability in these appearances. On the contrary, we seem guided easily towards an interpretation which promises to remove every difficulty.

Parallel lines apparently seen where no parallel lines can be reasonably supposed to be, suggest certain optical phenomena in which we see parallel lines as the optical images of lines really single, circles as the optical images of points, and other optical products—as they may be called since they are not optical illusions—which by no means correspond with the real nature of the object under observation. The optical image of an exceedingly fine bright line on a relatively dark ground observed through a telescope is a broader bright line, on either side of which run two parallel lines much less bright, and outside these again other still fainter lines. Under particular conditions of relative lustre in the source of light the eye would recognise only the two relatively dark parallel bands on either side of the median bright streak of measurable width (depending on the aperture of the telescope employed).

Is it not, on the whole, more likely (to say the least of it) that what Schiaparelli has taken for sets of double canals are simply the two relatively dark streaks on either side of the bright diffraction images of exceedingly fine luminous streaks on Mars, than that those objects are really "double canals" on the enormous scale imagined, or that the

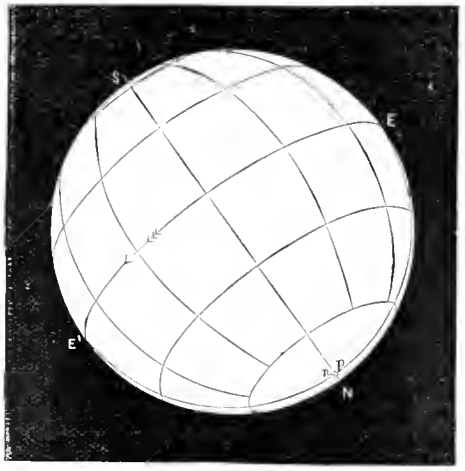


Fig. 3.—Meridians and latitude-parallels of Mars on the meridian, May 1, 1888, for an inverting telescope.

phenomena are otherwise wholly inconsistent with "admitted terrestrial analogies?"

The varying aspect of these objects would be readily explained on this supposition, nay, would be a necessary consequence of the hypothesis that the luminous streaks are Martian rivers, Moreover, the change of appearance would be likely to occur at precisely the season when Schiaparelli has found that it does occur.

Rivers on Mars would be far too delicate objects to be seen with their own proper outlines even with the most powerful telescopes, whether they were bright streaks on a darker ground or dark streaks on a lighter ground. It is not likely that there is any river so large as the Nile, probably there is not one so large as the Danube or the Volga on the planet Mars, and a river would have to be at least twenty times as wide as the Nile, taking the average of the lowest five hundred miles of its flow, to be seen with the telescope at Mars's distance. Usually a river if visible would be seen as a dark streak on the lighter background of the continent, just as the Martian seas are usually darker than the lands. Such a river would be perceptible, though not actually visible with its true outlines, through a good telescope, as a dusky streak many times broader than the river itself. But

if under special atmospheric conditions there were mists over the waters of the river, or the river being frozen remained snow-covered in spring after the snows had melted from its shores, the river would be bright on a darker background, and then the diffraction image of the river would appear as a broad band of light between a pair of parallel dark streaks. At other times the river would not be seen at all, the continent with its rivers being more or less enshrouded in cloud and mist.

It seems reasonable to suppose that (1) during the winter months of the northern hemisphere the rivers on Mars would not be visible, or would at least not be conspicuous; (2) after the vernal equinox the clouds and mists hiding the continents and rivers in great part from view would melt away, but would linger longest over the river beds; and (3) as summer approached the mists would melt away during the midday hours over the rivers also. The observations of Schiaparelli, as I have endeavoured to interpret them, correspond with this sequence: for (1) in the winter of north Mars no dark streaks are seen, or but few, and those indistinctly; (2) in the spring are seen the parallel dark streaks; and (3) towards summer the duplicated streaks become single.

Now during May, June, and July, Mars will be passing through the late summer and autumn of his northern hemisphere, and it will be interesting to inquire whether the dark single streaks, indicating clear skies over the river beds of Mars, change again into the dark double streaks indicating mist along the river tracks, before passing as winter advances, under those envelopes of mist and cloud, which will hide the rivers altogether from our view.

I give in fig. 2 the construction for determining the position of the polar axis of Mars, and the opening of the equator on May 1.* From that date onwards the planet's presentation will not differ importantly while the planet is favourably situated for observation, so that fig. 3, the projection for the inverted telescopic aspect of the planet (on the meridian) will serve well enough to the end of this Martian season.

WEIGHING THE EARTH.

(*Concluded from page* 125.)

THE principle of the method is illustrated in fig. 1. Here a and b are two small globes at the ends of a uniform rod $r\,r'$, suspended in a horizontal position by the cord or wire $c\,C$, attached to its centre C. The horizontal rod, left to itself, tends to a mean position which may be called the *position of rest*, though, as a matter of fact, when the suspension is as delicate as it has to be in the experiments considered, the rod never is at rest, but oscillates constantly, and very slowly, through short arcs on either side of its mean position. A and B are two heavy globes, which can be brought readily into such positions as are shown in fig. 1, where their attractions tend to draw a and b towards them in the directions shown by the arrows. The result of these disturbing influences is to sway the rod $r\,r'$ from what had been its position of rest, when undisturbed, to some new position of rest, as $n\,n'$ or $m\,m'$, about which it oscillates as before.

The processes of observation are as follows: First, the time of oscillation of the undisturbed rod is noted, to ascertain the force of torsion which has to be overcome to produce a given displacement. Then, the large globes being brought up to such positions as A and B, their distance from the positions of rest of a and b when these were undisturbed is carefully measured, and the new position of rest taken up by a and b is ascertained, the times of oscillation being noted throughout, so that any change in the torsion may be recognised and taken into account. This having been done, the globes A and B are removed to the mean positions M, M', and the balls a and b are allowed to return to their position of rest. Then the globes A and B are carried round in the same direction until A is close by b on the left, and B close by a on the right, when their attractions tend to displace a and b in directions contrary to those shown by the arrows: the position of rest of the rod $r\,r'$ is next ascertained (the times of observation being throughout carefully noted) as before. From these observations, the attractions of the globes A and B on the balls a and b (or b and a) can be determined, since the times of oscillation indicate the torsion, and the position of rest determines how much of the torsion is overcome by the globes' attraction. By calculating next what the attraction of either globe would be if, instead of being at its measured distance from the neighbouring ball, it were at the earth's centre, and comparing this with the known attraction of the whole earth, we can ascertain how much the whole mass of the earth exceeds the known mass of the leaden globes: in other words, we can ascertain the mass of the earth, and

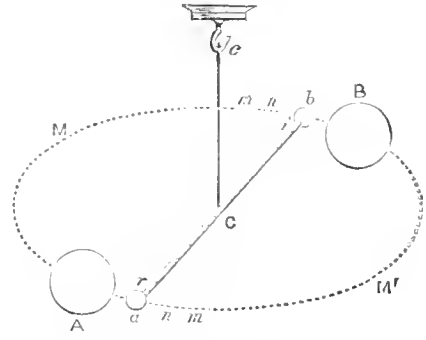


FIG. 1.—Illustrating the Principle of the Cavendish Experiment. (*Baily.*)

therefore—its volume being known—we can determine its mean density.

Cavendish, near the end of last century ("Phil. Trans.," 1798), applied this method in a form somewhat simpler than that described, but depending practically on the same principles, deducing a mean terrestrial density of 5·48. Hutton, re-examining Cavendish's experiments, reduced the deduced density to 5·32; but many prefer Cavendish's own treatment of his observations.

The experiments made by Cavendish were not very numerous, neither were those of Reich, of Freiberg, who in 1838 deduced by the same method a mean terrestrial density of 5·44. We must attach much more weight to the experiments made by Francis Baily in 1838-42, since they were not only conducted with singular care and caution, but were obtained in many different ways (though, of course, all by the same general method) and by a very large number of experiments. It will be well to give a few details respecting Baily's work, that the trustworthiness of his estimate of the earth's weight may be fully recognised.

The rod $r\,r'$, fig. 1, of 6$\frac{1}{3}$ feet long, was of light wood (in nearly all the experiments), and was suspended in various ways in the different experiments, viz., on single copper wire ·0178 inch and ·0219 inch in diameter; on two parallel iron wires 0·177 inch, 0·367 inch, and 0·415 inch apart; on two brass wires 0·380 inch and 0·415 inch apart; and on two silk fibres 0·177 inch, 0·367 inch, 0·380 inch, and 0·415 inch apart. At the ends of the rod were attached balls of dif-

* See KNOWLEDGE for February 1, 1884 (vol. v.), p. 71, for an account of the simple process to be followed in all such cases.

ferent material and size in different experiments, viz, 1½-inch platinum, 2-inch ivory, 2-inch glass, 2-inch zinc, 2-inch lead, 2½-inch lead, and 2½-inch brass. In a small number of experiments (fifty-six) the wooden rod was replaced by a brass rod without balls. The torsion rod and its suspension were enclosed in a case with a glass at one end. The devices by which the effects of electricity, magnetism, radiation, and other disturbing influences were as far as possible eliminated need not be described, nor the multitudinous experiments considered by which explanations of irregular discordances were sought for or corrections introduced. Nor is it necessary to describe or picture Baily's instrument either as a whole or in detail—the general principle of his method, already sufficiently explained, being all that is wanted and all that the student really needs to understand. Let it suffice to note that the experiments for the correction and explanation of discordances were more numerous than those actually employed for the determination of the earth's mean density.

The experiments thus used amounted in all to 753. Of these, however, 56, above-mentioned, when only a brass rod was used, were not seriously intended for the determination of the earth's mean density. They are well described by De Morgan as "a defiance to the apparatus to fail if it could." Yet they indicated a mean density below 6—a result much nearer the truth than the Harton Colliery experiments had given, costly and complicated though they were. The remaining 697 experiments gave results ranging from 5·5 to 5·847. The mean value deduced by Baily (due weight being given to each set of experiments) was 5·66.

Cornu, in 1872, applying the same method with improvements suggested by recent scientific developments, obtained the value 5·56. He did still better work in applying to the more numerous experiments of Baily, as recorded, corrections justified by recent physical discoveries. He found that as thus corrected Baily's elaborate and beautiful experiments indicated a mean earth-density of 5·55.

The following table presents the results of the application of Michell's method:—

Cavendish	5·48
„ (revised by Hutton)	5·32
Reich	5·44
Baily	5·66
„ (revised by Cornu)	5·55
Cornu	5·56
Mean	5·51

The true mean value of the experiments made by this method, due weight being given to each result, and Cornu's revision of Baily's experiments being accepted, is so near 5·55, that this may fairly be taken to represent the most probable mean density of the earth, the error being probably not more than 0·5—in other words, the density of the earth probably lies between 5·5 and 5·6.

Taking the earth's mean density at 5·55 times the density of water, the earth's mass = 590,654,000,000,000,000,000 tons.

The earth's equatorial radius contains in round numbers 20,926,200 feet, the polar radius being $\frac{1}{289}$ less, and 35·943 cubic feet of water weigh one ton. Hence, the earth's mass, expressed in tons,

$$= \frac{5{\cdot}55}{35{\cdot}943}\left(\frac{4}{3}\right)(20{,}926{,}209)^3\left(\frac{288}{289}\right)(3{\cdot}14159)$$

which when duly worked out (the use of logarithms will greatly help the reader who cares—as every reader should—to test the calculation) gives the above value.

There is a method by which, I think, the mass of the earth might be directly compared with that of a known mass of lead or other heavy metal, without the difficulty arising from the varying torsion, under varying conditions, in the Michell method. The plan suggested (but in an unworkable form) by Professors Richer and Mayer, of the Berlin University, will be readily understood from figs. 2 and 3. A B D is a globe of lead, which might be three or four feet in diameter, whose centre is at C. At M, the highest point of this globe, a small steel block is set, on which rests the knife-edge c of a balance $a\,c\,b$. The large globe A B D is pierced along the vertical directions A D and B E, immediately under the extremities a and b of the balance-arms $c\,a$ and $c\,b$, in such sort that the balance can be used to weigh bodies either above A B or below D E, or one above A B and the other below D E, as in the case illustrated in fig. 2, where a weight w above A is weighed against a

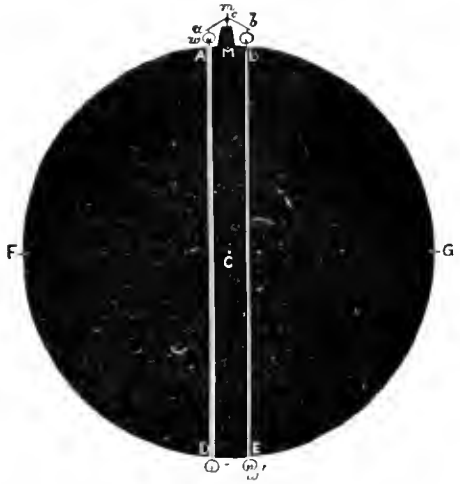


Fig. 2. Illustrating a plan suggested for weighing the earth directly against a globe of heavy metal.

weight w' below E. Fig. 3 shows the balance on a larger scale, and illustrates the arrangement suggested as best for applying the weights. Immediately above the centre-piece c (the knife-edge of which rests on the horizontal surface $k\,l$ at e) is a thin plate of polished steel which, when the balance is level, has its plane at right angles to the then horizontal direction $a\,b$. A horizontal beam of light from a distant source, situate either on the left or on the right of the apparatus as pictured, falls on this steel mirror, and when the balance beam is level returns after reflexion upon its horizontal track, but when the beam is inclined the return ray is inclined to the horizon. Thus the reflected ray practically serves as a very long index by which to measure the deflection of the balance. [In the actual experiments the light could be sent out and received as in the observations for determining the velocity of light by Fizeau's and Wheatstone's methods.] Two weights exactly equal and similar suffice for all the experiments, but preferably four should be provided, so that in any set of experiments there need be no occasion to transfer a weight from above the large globe to below or *vice versâ*. It would be desirable also that sets of weights of different materials should be employed, so that diversities depending on the physical qualities or inter-relations of different substances might be eliminated. The weight-holders are shown in fig. 3 at p, q, p', and q'. Their construction should be such that with the least amount of disturbance a weight, such as is shown at p and q', may be added, removed, or transferred, as the experiments proceed. The scale-pans and weights should depend from knife-edges at a and b, in the usual way where delicate weighing is required.

The method of the experiments is as follows in a case where a full set of four weights is employed:—

All the four weights to be used in a given set of experiments are to be first carefully weighed against each other, in pairs, above A B and below D E, every pair being thus tested, each weight in each test being put on one side of M in one trial and on the other side in another, and the indications of the long light-pointer carefully noted in each of the twenty-four trials thus made. [Six pairs of weights can be selected from the four; and taking any pair, w and w', these can be weighed against each other in two ways in the upper weight-holders, and in two ways in the lower, or four ways in all. Thus twenty-four weighings must be made to eliminate all errors arising from differences—however minute—between the weights.] Next each pair of weights must be balanced against each other, one being above and the other below. One such trial is illustrated in fig. 2. The weight w above A, which should exactly balance the weight w' set in the scale-holder above B, will not balance

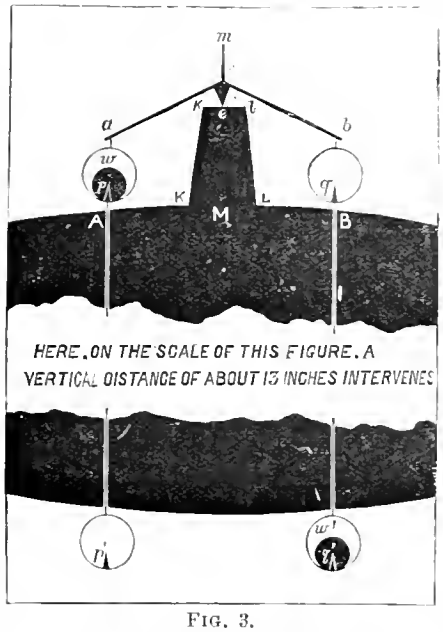


Fig. 3.

w' set below E. For while each is drawn downwards with equal force by the earth's mass—or with only such minute and calculable difference as results from the distance of w from the earth's centre being greater than the distance of w'—w is drawn towards C, or *downwards*, by the attraction of the great globe A B D, while w is drawn towards C, or *upwards*, by the same attraction. The amount of deflection, as indicated by the light-pointer, is to be carefully noted; then the weight w is to be transferred to B and the weight w' to D, when an opposite deflection will take place, which is to be similarly noted. Next the two experiments are to be repeated, the weight w' being above and the weight w below. Corresponding experiments are to be made with each of the six pairs of weights which can be formed out of the four. The mean of the observed deflections compared with the mean of the twenty-four preceding observations (in all of which the beam is approximately horizontal) will supply the means of comparing the attraction of the earth with the attraction of the globe A B D. Of course many details must be taken into account: as, the weight of the wires or cords along A D and B E; the angles such as C w D and C w' B when w and w' are in equilibrium; the difference of the distances of w and w' from the earth's centre; and the like. But all such matters are readily calculable from the original data and the indications of the ray-index.

Here is a rough calculation of the effects we may expect to recognise in such experiments:—

Supposing the globe A B D to be of lead, and therefore of twice the mean density of the earth, and 4 feet in diameter, its mass compared with that of the earth is as $2(2)^3$ to $(10{,}500{,}000)^3$; but the weights w and w', neglecting their distance from the surface of the large globe and from the vertical diameter, are only 2 feet from the centre of the globe, while they are 10,500,000 feet from the centre of the earth. On this account the attraction of the globe is greater than the attraction of the earth as $(10{,}500{,}000)^2$ is greater than $(2)^2$; and since the attraction of the globe is exerted upwards on one weight and downwards on the other, we must regard it as doubled, and this doubled attraction as practically again doubled by the interchange of the ends of the balance from which the upper and lower weights are severally suspended. It follows that while the attraction of the upper globe, so far as it depends on mass, is less than the earth's in the ratio

$$2\,(2^3) \text{ to } (10{,}500{,}000)^3$$

it is increased, through the diminution of distance and the adjustment and interchange of the weights, in the ratio

$$4\,(10{,}500{,}000)^2 \text{ to } (2)^2.$$

Hence, finally, the effect of the leaden globe's pull, quadrupled as in the experiments, bears to the effect of the earth's pull the ratio compounded of these two, viz., the ratio

$$16 \text{ to } 10{,}500{,}000.$$

So that if our balance, with its ray-index, is delicate enough to measure a difference of weights amounting to about $\frac{1}{656{,}000}$ of the weight used, we may expect this plan to afford a direct, and in that respect satisfactory, comparison between the mass of the earth and that of a globe of known size and density.

[It might seem as though the slight difference of distance of the two small weights from the earth's centre might be neglected. Lord Brougham incurred some just ridicule for the rather strange mistake of asserting that a man can carry a weight more easily over his shoulder than in his hand, because in the former position the weight is farther from the earth's centre. But in delicate experiments such as we are considering in the text, the difference due even to a few feet of distance must be taken into account. Thus, suppose A C to be 2 feet, or w rather more than 4 feet farther from the earth's centre than w'; then, since the earth's radius contains in round numbers 21 millions of feet, we may take w to be $\frac{1}{5{,}000{,}000}$ nearer the earth's centre than w, by which difference the attraction of the earth on w' is increased by $\frac{1}{250{,}000}$ part. This, though minute, is appreciable, even considerable, in relation to the quantities we are dealing with in these experiments.]

ELECTRIC LAMPS FOR COAL MINES.

By Wm. Lant Carpenter.

In an article on miners' lamps and colliery explosions in the April number of Knowledge, Mr. W. Mattieu Williams alludes at the end in very brief terms to the electric lighting of mines. This may be, and is, done in two ways. In some cases the main thoroughfares, and many of the branch ones, are lighted by glow lamps, which are permanently fixed, and supplied with current from a dynamo machine, sometimes above, and sometimes underground, driven usually by a steam-engine. The greatest progress made lately, however, is in the construction of portable lamps, containing either primary

batteries or small accumulators. The weight of several patterns of these scarcely, if at all, exceeds the weight of some patterns of oil lamps at present in use. They give a light for at least twelve hours without any attention, exceeding in intensity that of the ordinary oil lamp, and they can be placed in *any* position, so as to illumine the roof, the floor, or the sides of the mine, wherever the coal is being "got." In fact it has been objected that they give *too much light*, and that miners who use them are liable to be frightened when they see the risks they run! The incandescent filament is doubly protected, first by its own globe, secondly by a very strong glass cap, and sometimes there is water between them, as a precautionary measure. I entirely demur, however, to Mr. Williams's statement that "the breaking of the glass bulb of an incandescent lamp would expose a filament of burning carbon nearly as dangerous as a flame," and I venture to think that if Mr. Williams had tried to explode a mixture of fire-damp and air by breaking such a lamp in it, he would have found it a much more difficult task than he imagines. As a matter of fact, the filaments used in these small lamps are so minute, that even if they escape being quenched by the water (supposing that to be present) there are only very few explosive mixtures which they can be made to fire. Mr. Williams's last objection, that "their worst defect is the absence of warning which is given by the behaviour of the common lamp flame," was met more than a year ago by Mr. J. W. Swan (formerly of Newcastle), with whose lamp I am tolerably familiar. To this lamp a most ingenious firedamp indicator is attached, which not only gives warning, but enables the overman, or even the trained miner himself, to ascertain, by an observation lasting only a few seconds, how much (within 0·5 per cent.) firedamp is present in the atmosphere at the moment of observing.

The question of comparative cost can, of course, only be arrived at by the use of these lamps on as large a scale as oil lamps are now used, in some large well-managed mine. As some thousands of these lamps are coming into use, we may shortly expect some reliable data on this point. I may conclude by pointing out that, in the case of those lamps run by portable accumulators, the process corresponding to lamp trimming is of the simplest possible description. In the base of each lamp are two tiny sockets; when the lamps are handed in at the end of the shift's work, the sockets of each one are fitted on to a pair of wires projecting from a board on which hundreds of such lamps may be placed. These wires are in connection with the terminals of a dynamo, and thus, while the miners are above ground, one engineer charges the whole of them, while his engine is probably doing other work as well. Can anything be simpler?

DISEASE GERMS.

NONE of the results of modern scientific research are more interesting than the discoveries relating to disease germs. Apart from the relation of these discoveries to the diseases which affect humanity, they are of interest as disclosing to us a world of minute life, of which in former ages men had scarcely even any conception. They regarded plague and pestilence as specially appointed visitations, not as obeying laws as strict, though (even now) by no means so well understood, as those regulating the development of the higher forms of animal or of vegetable life. Possibly some of those who are anxious to find constantly fresh proof of the truth of the saying that there is nothing new under the sun, may consider that the modern theory of living death germs is embodied in the sixth verse of the ninety-first Psalm, where (following the Prayer-book version) we are told of the "pestilence that walketh in darkness," and the "sickness that destroyeth in the noon-day," but, on the whole, such an interpretation must be regarded as far-fetched; and, certainly, so far as definite statements are concerned, the theory of poison germs must be regarded as less than a century old. Within that time one disease after another has come to be regarded as resulting from the development of invisible germs by a process something akin to fermentation, sometimes more suggestive of algoid life.

I do not propose to do more than touch here the general theory of disease germs, considering more fully only the evidence we have of the possibility, in certain cases, of developing innocuous germs from those which produce destructive diseases.

At the outset I would touch on the curious question whether a process akin to natural selection in the germ world may not modify the character of these germs in ways resembling those which have been adopted for their artificial modification. The various forms of life represented by these minute organisms have their stages of development like the higher forms of life, but lasting a much shorter time, so that within a very short portion of the life even of an individual man, hundreds of generations of germ-life may pass. Again, the lives of these germs doubtless depend on their environment; and the various species so undergo during the course of many generations changes akin to those which affect (in many generations of their much longer lives) the higher orders of life, animal and vegetable. Hence, during the lifetime of an individual, and far more during several generations (as we measure time) the character of the disease germs to which small-pox, typhus fever, scarlet fever, measles, and other such zymotic diseases are due, may undergo marked alteration. We could thus understand the more or less deadly character of such diseases in particular years, and also in particular regions. We can also understand that some of the diseases of ancient times which seem to have disappeared may in reality be represented by diseases of the present day which resemble them in certain respects, but are nevertheless distinct diseases, and in particular differ markedly in destructiveness.

For example, the plague, as known in Europe only two centuries ago, has certainly no modern representative in the countries where it was once so greatly feared—if it exists anywhere. What is to-day called "the plague" in Oriental countries is a different disease. Yet there are reasons for believing that our typhus fever is in reality akin to the "black death" of old times. The story is well authenticated which tells how in the place where certain victims of the great plague of 1665 were buried, death and disease lurked in wait, and nearly two centuries later found victims among workmen employed to dig in the place where a pit had been prepared for the corpses too numerous to be buried in separate graves. But the illness which fell upon four of these workmen, and on seventy others who contracted it from them, was not the plague but simply typhus fever. Assuming, as we may fairly do, that the germs of the plague disease caused the fever which attacked these nineteenth century workmen, we have evidence that the typhus fever of our time is the direct descendant of the plague of former ages. For, as Miss Florence Nightingale neatly put the problem of the propagation of disease, small-pox can no more generate scarlet fever, or scarlet fever measles, than a race of dogs can produce a race of cats, or a race of cats a race of rabbits. Typhus, generated by germs of the plague disease, indicates clearly the kinship of the two diseases, distinct though they now seem.

The evidence is not quite so clear in the case of vaccinia and small-pox; since it has not yet been demonstrated that protection against a particular disease can only be given by passing through a disease actually akin to it. It might be argued that as the particular effects of quinine which give protection against malaria argue no kinship between malaria and the action of quinine, so the protective influence of vaccine inoculation does not necessarily prove that the germs which produce vaccinia (the disease, if so it can be called, following vaccination), are the same in species as those which produce small-pox.

Still, in the light of recent evidence respecting zymotic diseases and germ diseases generally, it may be regarded as practically certain that the disease germs of vaccinia are the direct descendants of small-pox germs, which, during their residence in the heifer have undergone a certain modification rendering them innocuous; while, nevertheless, introduced into the blood of the human body, they produce that particular change which results in what we call "protection" against small-pox. This being so, it may be regarded as probable that in the case of any other disease known to be produced by germs, methods of cultivation may be discovered by which the disease germs may be so cultivated as to lose their fatal power, while generating a disease sufficiently akin to the more dangerous illness to render the patient safe thereafter or for a while against its influence. So that, as I pointed out several years since, when as yet such expectations were regarded as fanciful, typhus, scarlet fever, diphtheria, and a host of other ailments, which are known to be due to the presence of living organisms in the blood or tissues, may be treated as we now treat small-pox.

I may touch here on the ideas of that troublesome and foolish class of persons who call themselves "anti-vaccinationists." The strict action of the vaccination laws in England—a country whose people have by no means been disciplined into such strict obedience to Government control as continental nations—has excited opposition, not only from persons who recognise the mischief of undue interference with the people, but also from those who are too ignorant to be capable of appreciating the evidence respecting the protective influence of vaccination. A Herbert Spencer may reasonably object to laws forcing the unwiser and emphatically least valuable portion of the population to protect themselves against disease and death. But such objections to compulsory vaccination are not to be confounded with the idiocies of the Anti-Vaccination League. Those who object to compulsory vaccination *quâ* compulsory, are among those who recognise most clearly the protective influence of vaccination. But inasmuch as this protection is open to all, and will be taken advantage of by the most sensible, while the spread of small-pox from the foolish sort who will not seek this protection, can always be prevented by renewed vaccination among the rest, it is evident that compulsory vaccination tends to preserve the unwise opponents of vaccination—a decidedly mischievous result considered in itself. The very fulness of a man's appreciation of the value of vaccination as a protective against small-pox, may conceivably lead to his objection to compulsory vaccination. It by no means follows that a man does not approve of a good thing because he is unwilling that every one should be compelled to partake of it; often quite the contrary, in fact.

It ought to be unnecessary to cite evidence of the protective influence of vaccination, but I may here note two cases which seem to me singularly striking:—

1. Zurich Canton. The law of compulsory vaccination was repealed in 1883. Official returns recently published by Professor Dunant, enable us to judge how many of the more foolish sort (unfortunately, their babes for the most part, but in such questions we must consider the class not the individuals) would have been preserved had the law been left unchanged. The death rates from small-pox between 1881 and April 1886, were as follows:—

Date.	Deaths.
1881	7
1882	0
1883	0
1884	11
1885	73
First quarter of 1886	85

2. In Germany vaccination is compulsory; in France it is not. Now, Dr. Jassen points out among many other striking examples of the efficacy of vaccination that during the year 1885, in twenty-one towns in Germany, having an aggregate population of 4,000,000, the deaths from small-pox numbered twenty-seven; in fifteen French towns, having the same aggregate population, the deaths from small-pox amounted to 866.

The significance of such results, which might be almost indefinitely multiplied, will be recognised still more clearly when we remember that deaths from small-pox are far from being the worst results of an epidemic of the disease.

It is noteworthy that men who seem careless about applying the protective influence of vaccination to their own families show a marked zeal in seizing at any protection for their cattle which kindred methods may provide. Thus, though Pasteur's researches into the terribly destructive disease known as splenic fever (sometimes called anthrax or charbon), were at first ridiculed and his conclusions opposed, the proprietors of flocks and herds agreed with admirable unanimity in accepting his means of protection as soon as the validity of his system had been demonstrated. The history of anthrax is instructive. The disease resembles the black plague in its action and in the rapidity with which its effects are developed. In bad cases death occurs in twenty-four hours. Where the disease is very prevalent proprietors have been ruined by the entire destruction of their flocks and herds. Between the years 1867 and 1870 no less than 50,000 deaths occurred among horses, cattle, and sheep in the district of Novgorod, in Russia, while 568 human beings perished to whom the disease had been in various ways communicated.

Pasteur's inquiries into the development of anthrax were characterised by the same combined patience, ingenuity, and keenness which he had shown in his researches into pebrine, the silkworm disease. So soon as he had recognised the true nature of the anthrax bacillus he studied methods for cultivating it so as to mitigate its poisonous effects. His method consisted (or rather consists) in cultivating the bacillus in meat-juice or chicken-broth, to which air has access but not dust. A certain time is allowed to elapse before it is employed for inoculation. If this period does not exceed two months the virulence of the bacillus is little diminished; but if it is extended to three or four months, the disease produced by inoculation is less severe and a considerable proportion recover; if the time is prolonged to eight months the disease produced by the bacillus is so mild that none of the inoculated animals perish, all quickly regaining full health and vigour, while all are safe, for at least a considerable period, from the deadly attacks of the veritable anthrax.

It was not until a crucial series of experiments (such as cannot be made when human beings are in question) had been carried out, that Pasteur's system of treatment was adopted. A flock of fifty sheep was at his disposal. He vaccinated (to use a convenient if not quite correct expression) twenty-five of these with the cultivated anthrax poison, repeating the operation a fortnight later. All the animals thus treated passed through a slight illness, but at the end of the month were as well as the remaining twenty-

five. He now inoculated all fifty with the strongest anthrax poison, predicting that within twenty-four hours, or before six o'clock the next day, the twenty-five which were inoculated for the first time would all be dead, while the others would be perfectly well. A large number of cattle proprietors, veterinary surgeons, cavalry officers, and others interested in animals, gathered next day on the field where were the subjects of the experiment. At two o'clock twenty-three of the unprotected sheep were dead; the twenty-fourth died at three; the twenty-fifth at four. But the twenty-five vaccinated sheep were all in perfectly good condition. One of them, who had been purposely inoculated with an extra dose of the poison, had been slightly indisposed for a few hours, but he was now as well as the rest.

It is hardly necessary to say that the experiment was regarded as decisive. Cattle owners needed no persuasion to induce them to adopt Pasteur's system.

Pasteur's researches in regard to hydrophobia are in some respects still more interesting, because they relate to a malady which is derived directly from external matter, not propagated from disease germs. It would not be possible to describe here the way in which Pasteur dealt with the original inquiry into the part microbes play in this terrible malady; or to discuss the various processes which he tried for cultivating the hydrophobic microbe into a form which should be innocuous yet protective. All the world now knows that he has succeeded. In case protection cannot be secured by a single inoculation, as with small-pox and anthrax, a series of inoculations have to be performed, each more stringent, so to speak, than the preceding, until at last the inoculations are such as would kill a patient not prepared by previous inoculations.

The difficulty in cases of hydrophobia, so far as inoculatory cure is concerned, is that the full poison has been already received by the system, may even have been at work for many days, before the milder forms of the poison are injected. It might well have been supposed that the fatal first-comer would be first in its action, and therefore death inevitable. Probably Pasteur had little hope at the beginning of his researches that he could cure the bitten, expecting only to protect the unbitten. But it turned out otherwise. Pasteur's system may be regarded as now a demonstrated success. The proportion of deaths among the cases dealt with has been so much smaller than among similar numbers not protected by Pasteur's method as to assure us of the protective value of his system even at this early stage of its adoption; while the cases in which the system has failed have been without exception such as from the beginning presented small room for hope, the bites being exceptionally severe, or on the head, or by mad wolves, and the interval before the protective system was employed being unduly long. Professor Ray Lankester correctly presented the results of Pasteur's work when he said that "unless we assume falsehood, such as for wickedness and folly would scarcely ever have been equalled, we must recognise Pasteur as having obtained results which of themselves will for ever place him high among the benefactors of the human race."

Lockjaw, though it is usually the result of wounds given by substances not likely to convey disease germs into the system, is beginning to be recognised as due to microbes already existing in the blood, and made actively mischievous by local inflammation around the wound, generally lacerated, which is the original cause of the trouble. Whether any method of treatment will hereafter be suggested by this discovery, should it be eventually demonstrated to be real, remains to be seen.

We are justified in believing that as protection has already been found against some germ diseases by taking advantage of naturally cultivated (and mitigated) germs as in the case of small-pox, or of artificially cultivated germs as in the case of anthrax, so protection may be obtained against cholera, diphtheria, typhus, scarlet fever, and other more or less destructive diseases which have been clearly shown to be due to specific disease germs.

FAIRIES, ELVES, AND DWARFS.

By Stella Occidens (Mary Proctor).

> Like that Pygmæan race
> Beyond the Indian mount, or fairy elves
> Whose midnight revels by a forest side
> Or fountain some belated peasant sees
> (Or dreams he sees), while overhead the moon
> Sits arbitress, and nearer to the earth
> Wheels her pale course; they on their mirth and dance
> Intent, with jocund music charm his ear.
> At once with joy and fear his heart rebounds.
>
> *Paradise Lost.*

ELVES and dwarfs, though minute in themselves, yet form a prominent part in the folk-lore of Europe, and many wondrous legends concerning these beings have been handed from ages down; a nurse's tale,

> Which children open-eyed and mouth'd devour,
> And thus, as garrulous ignorance relates,
> We learn it and believe.

In Scandinavian mythology Alfheim is the home of the light elves, who are fairer than the sun, and about whom we hear very little. The dark elves live underground in Svartalfaheim, and are blacker than pitch. They are full of mischief, but can be good-natured little beings when they wish. Their sooty appearance is explained by the fact that they work in the mines underground, and forge metals which are found in the caves and mountains. These dwarfs, it is supposed, are very skilful in metal-work, and also in magic, on which account they are greatly feared by the peasants, who dare not provoke them. Many years ago the dwarfs had a great conflict with superior beings, and being defeated, were compelled to dwell in the caves and underground. From other accounts we read that they were formerly a race of Oriental Lapps, who immigrated into Sweden and Norway later than the Finns, who were the descendants of the giants, and are therefore the oldest of the races that now occupy Scandinavia.

The dwarfs who dwell in the mountains are reported to own vast treasures of gold and silver, whilst the chambers of their palaces are supported by jasper columns, and the walls glisten with crystals and precious stones. In fact, these little beings have been actually seen pushing large chests full of gold and silver from one hill to another, in preparation for one of the grand entertainments they often have among themselves. They do not like noise, and it is supposed that their almost total disappearance from the country is due to the ringing of church bells. The elves or hill-people are an entirely different race, though they also live in mountains and caves, are very rich, and have a great dislike for noise. They do not work in the mines, but love music and dancing. They are commonly called *huldrefolk*, and their music is called *huldreslaut*. On summer nights, when the moon is shining, they can be heard on the elfin hills, and those who have been fortunate enough to hear them say that their music is mournful and chanted in a minor key. If a word should be spoken during their song, it will be turned into wailing, as by this their hope of salvation is destroyed. The peasants believe that these beings contain the souls of the departed who thus expiate their sins on earth. Some of the Norse fiddlers

have learned the *huldreslaut* by listening carefully, and a few can play the elf-king's tune, which is so magical in its power that all who hear it, and even inanimate objects, are compelled to dance. The unfortunate fiddler must continue playing until he can play the air backwards, or someone comes behind and cuts the strings of his fiddle.* The stromkarls are so musical that trees dance and waterfalls cease flowing, to listen to the enchanting strains of their music.

The *nisses*, who also belong to the dwarf family, resemble the German *kobolds* and the Scotch brownies. They render great services to thrifty housewives, who often find all their work done for them in the morning. Unlucky is the house which is not favoured by their presence. They usually dress in grey, and wear a pointed cap.

Sometimes the Northern dwarfs called on their neighbours in Denmark. We read about the old goblin king of the Dovrefeld, who visited the Danish elfin king, and in whose honour a grand banquet was given. The most select were invited, and the will-of-the-wisps lighted them on their way. Some mischievous little imps led them into bogs, but those were principally the church-dwarfs [I trust nothing inconsistent with due respect for the Church is here intended.—R.P.] or the night-ravens, who were not very welcome at any time. Grand preparations were made for the reception of the king, and the palace was gorgeously decorated with gold and silver, which glistened in the moonlight with which the floor was bathed. The fairy elves were clad in gauzy raiment of moonshine and mist, and they shivered, as the king from the North, with his ice crown, and the icicles hanging from his beard, drew near. We are told that he was enchanted with the dancing of the Danish king's youngest daughter, and returned with her to Norway.†

The Russian dwarfs are not quite so pleasant to deal with, being malicious and spiteful. They are called *leshy*, or wood-demons, which does not sound promising. The following legend is an instance of their evil habit of stealing. Once upon a time a fair maiden went for a stroll in the woods, without her father's permission, and lost her way. She was not seen again for three years, when a hunter passing through the forest, also lost his way. He looked around him to discover where he was, when he spied a little moujik sitting on a log, plaiting a shoe. The strange little being kept looking at the moon, saying—

"Shine, shine, O bright moon!"

The hunter gazed in wonder at the little mortal, who, though only two or three spans high, was as grey as an old man. But the dwarf read his thoughts.

"Grey am I," said he, "being the devil's grandfather."

The hunter then recognised in him a wood-demon, and taking aim, he shot at him. The moujik was wounded, but managed to crawl home. The hunter followed him till he came to a hut in the fissure of a rock. Opening the door he saw a maiden standing beside the *leshy*, who was now dead. He persuaded her to return home with him to his village, where she was recognised as the lost one.‡

A German dwarf would have fared much better than the unfortunate little moujik, for he would have put on his little invisible cap, and vanished before the hunter could take aim. These elfish goblins wear a pointed red cap, which makes them invisible whenever they wish. They are very full of mischief, and have been known to rob a neighbour's pea-field, using the peas at night to pelt the windows of a house belonging to someone who had annoyed them. They have also been known to steal fair maidens, and one was kept for nearly eight years by an elfin king. Some of the dwarfs are very ill-shaped and ugly, and have duck's feet. In fact, this was proved by the good people of the little village of Arlisbach. One very severe winter the dwarfs would come every night to a house and sleep on the oven, but would vanish at dawn. They wore scarlet cloaks reaching to the ground, so that their feet were never seen. Some prying people sprinkled ashes in front of the house, and next morning, sure enough, the marks of duck's feet were to be seen. The little dwarfs were so angry at being discovered that they never came again, "and never will while men are so spiteful."*

The peculiarities of these dwarfs resemble the Norse. Like them, they live in rocks and woods, are great smiths, and forge iron and jewels. These smiths wear light grey coats and blue caps, and are often heard at night working at the forge. The elves are also very industrious, and spin and weave under the direction of Dame Holda. If one passes by an elfin-hill at night, and listens carefully, he can hear the elves spinning and the wheels humming, and it is supposed that the flying gossamer is spun by them. Then there are elves who are fond of music and dancing, and they can be seen on the moonlit meadows, but they vanish at dawn, leaving their footprints in the dew. They have been known to teach people to play on the fiddle in exchange for a grey sheep. It appears that the pupil has no chance unless he is fat; if he is thin he never gets beyond learning to tune the fiddle. If he is fat he must practise till the blood flows from his finger-tips; then he can play such enchanting strains that "the trees shall dance, and torrents in their fall stand still." This melodious stromkarl loves to linger by mills and waterfalls, and is to be seen on calm dark evenings, when he entices people by his music, like the Norwegian *fossegrim*.†

Some of the dwarfs are supposed to have made the knot-holes in the trees, and in Smäland it is said an elfmeid came into a house through a knot-hole in the wall, floating in on a sunbeam. She was married, stayed awhile, but four years later suddenly vanished the way she had come.

In South-East Germany many legends are told about wild-folk, moss-folk, and wood-folk. They scamper over mossy dales, and climb steep precipices inaccessible to human beings. These little mannikins are old and greyish-looking, and clothed in moss. Some are not good-natured, and live in the denser parts of the forest. They wear "green garments faced with red, and black three-cornered hats," an elf-like combination. The little wood-wives often come to woodcutters and ask them for something to eat and drink, and in return they will render them any service in their power.

The following is an example of the numerous legends told about these interesting beings. It refers to the belief that good luck would befall any one who could obtain a drinking-horn belonging to the fairies, even apparently though the horn were stolen. One hot summer's day Count Otho of Oldenberg, fatigued with hunting and overcome with thirst, threw himself on the ground, exclaiming, "Oh, for that I could have a drink of clear water!" To his surprise a beautiful maiden stood before him, holding in her hand a silver goblet filled to the brim with water. Count Otho drank it, but was so ungrateful as to run away with the goblet. However, he saved himself from the evil consequences which might have followed this rash act by giving it to the Church. As the goblet was of solid silver, and handsomely carved with delicate tracery in the Gothic style, it was a valuable gift. Perhaps the Count's account of the way in which he came into possession of this piece of silver was not so strictly truthful as might be wished.

* Anderson, "Norse Mythology," p. 202.
† Anderson's "Fairy Tales: The Elfin Hill."
‡ Ralston, "Russian Folk Tales," p. 213.

* Grimm's "Teutonic Mythology," p. 451, vol. ii.
† Ibid., p. 493, vol. ii.

NEVADA'S WALTZING GIANTS.

"BUT in Nevada," said a mining man from White Pine, "we have the sublimest dance that any man ever saw. We call it 'the dance of the giants.' Great cylinders of sand, from eight to twenty feet in diameter, and sometimes immensely tall, come careering across the desert with a whirling, waltzing motion that is very graceful. I have often seen them when they must have been two or three miles high, for their tops reached into the clouds. But oftener there will be one big column, with a lot of little columns attending it, all waltzing together. The effect is the strangest thing imaginable. It is both sublime and grotesque. It inspires you with awe, and at the same time fills you with the desire to laugh at the odd performance. And, if the man is superstitious, the weird, fantastic sight can make him feel mighty uncomfortable.

"They are never seen except in the summer time, and are most frequent in July. They have their beginning in some incipient whirlwind, which snatches up a handful of sand while the surrounding air is still, and then they keep on growing and moving onward.

"They are not like the cyclones farther east, for they move with very little noise, and, instead of being funnel-shaped, are of the same size from top to bottom. The motion is the same, being both circular and advancing. They draw up into the cylinder fabulous quantities of sand, tons of sage-brush, and sometimes good-sized stones.

"How far they travel nobody can tell. The very big ones must have waltzed along in their silent majesty over the lonely deserts for a long distance. They must travel the whole distance of the White Pine Valley, three hundred and fifty miles, and sometimes they come down through Spring Valley from Idaho to the Peranegat Valley."

THE STARS OF OTHER TIMES.

I DO not think I am a very lazy man; and in regard to mapping and charting, I think—though it may be sheer self-conceit—that I have at times been exceptionally hard-working. Probably not many thousands, or even hundreds, or tens of persons have given so much as 400 hours to a single map—possibly not one besides myself (unless I be thought somewhat beside myself to have undertaken such a work). Therefore I am not ashamed to explain the devices by which, when I can, I simplify the work of charting. I will go further. I regard the use of easy methods, when these are sufficiently accurate for the object aimed at, as akin to the use of those abridged processes of calculation by which the mathematician who has sufficient experience to work confidently in such ways, leaves out all such portions of the ordinary processes as are not essential. The average calculator will multiply and divide right out, extract his square roots and cube roots to the bitter end, take out every logarithm to the seventh figure, and determine, with like accuracy, the numbers corresponding to his logarithm, when all he needs (nay, perhaps, all he can at all trust) in his results may be three or four significant figures. This really is not accuracy; it is blundering: it is the result not of scientific care but of inexperience, very often in the weariness resulting from over precision of process the calculator makes mistakes seriously affecting the numbers finally deduced. In like manner, in mapping there are many devices which not only save trouble but secure a greater accuracy than the precise geometrical methods theoretically applicable to the problem.

Such is the method which I am about to describe as the one I have employed for preparing star maps showing the heavens at given hours and seasons, in given latitudes, at given epochs in the past history of the human race.

Take Maps I. and II. in KNOWLEDGE for March and April last. Having chosen any epoch and found the pole for that epoch, on the circle indicating in each map the pole's precessional path, it would be sufficiently easy to describe in each map the circle indicating the diurnal track of the zenith of the heavens around that pole for any given latitude—for instance, a circle 60° from the pole for the latitude of the Great Pyramid. It is also not difficult to set points round a circle thus determined so that they shall correspond to hour-differences of time—that is, to divide the circle into portions each representing 15° on the corresponding circle of the sphere. To complete further the projections of the visible hemisphere corresponding to such points as these for zenith points (*i.e.* centres of projection), is a sufficiently simple piece of stereographic charting—*theoretically*. But all this work involves careful attention to the details of the problem, some mathematical mental gymnastics, and certain geometrical processes which require considerable care and some skill in the execution. Then, owing to the unequal shrinkage of the paper, the results obtained by thus describing circles according to the principles of the stereographic method, are not so accurate as they theoretically ought to be.

The following is the method I actually employ in such work:—

I lightly draw in pencil the course of the circles of declination and right ascension in my "School Star Atlas" (dated 1880) among the longitude and latitude lines and stars of Map I. I then ink them in strongly, correcting while doing this the small irregularities affecting the light pencilling. Next I make two tracings of these lines (really circles and circular arcs) in red ink on tracing paper, one of these to be used with Map I., the other with Map II.

Suppose, now, that the epoch for which I want a series of maps like my "Half-Hours with the Stars," for England (latitude 51½° N.), or for the United States (latitude 38° N.), or for the southern hemisphere (latitude 38° S.), is that of the building of the Great Pyramid—I first find the right position of the poles for the year 3350 B.C., and the corresponding crossing points of the equator of that epoch on the ecliptic. (This, of course, requires only that the right arc for 3,150+1,880 or 5,030 years' precession, where the whole circuit requires 25,868 years, should be taken on the ecliptic and on the pole's path.) Then these three points being marked, the prepared tracing papers are adjusted—one over each map—so that the pole corresponds with the polar point thus determined and the equator crosses the ecliptic at the two marked points. When the tracing papers are gummed at the edges or corners in this position, the red circles and arcs are the declination-parallels and hour-circles of the heavens, for the epoch dealt with.

Now to obtain maps presenting the stellar skies of any latitude, we draw first on any projection we please (in my "Half-Hours" and "Seasons Pictured," I use the equidistant) the hour circles and declination-parallels corresponding to the latitude. This, of course, is a process depending on familiar principles of mapping [but I may take occasion hereafter to show how it may be conveniently effected for any projection, when once effected for the most convenient projection—the stereographic]. Then, having made twelve tracings (on drawing paper preferably) of this projection, we fill in the stars for these from Maps I. and II., the red

lines over which are meridians and declination-parallels corresponding to those in our tracings, the central meridian on each tracing being made to correspond successively with 0^h, II^h, IV^h, &c., up to $XXII^h$; or, if we care for more precise information, we make twenty-four maps presenting the stellar skies at hourly intervals for each night and at bi-monthly intervals round the year.

A NEW LOTTERY SWINDLE.

IN all the United States, save one, lotteries are regarded as illegal. That one State, Louisiana, professes to permit lotteries only for educational or charitable purposes, which does not prevent the State-supported lotteries of Louisiana from being conducted on a system whose only claim to fairness lies in the barefacedness of its unfairness. It openly proclaims itself a swindle, so confident is its trust in the folly of the majority, who will always pay ten dollars for a five-dollars' chance of winning a great prize. Unluckily the Louisiana Lottery leavens with its unwholesomeness the whole lump. In every State the advertising of the Louisiana lottery swindle is pursued more or less openly. The evil even reaches the old country, as I happen to know from personal experience; for having proclaimed openly the iniquities of nearly all lottery schemes and the folly of gambling generally, I am naturally regarded by the lottery scamps as secretly hankering to try my chance. So that from America and from the Continent, even from Australia, invitations reach me to invest in lotteries openly proclaimed in their own advertisements dishonest and delusive.

In passing, I may remark that if I believed in luck I should certainly be tempted to venture in some of these lotteries; for twice, though not from desire for gambling gains, I have tried my luck (as the foolish ones put it) in lotteries, and each time I have won a goodly prize. One trial occurred in Melbourne, Victoria, where I had been taken round the Chinese quarter, visiting opium dens, Chinese lottery dives, and so forth. The method of marking the Chinese lottery papers was explained to me by a practical example; I paid, that is to say, for the right, and made marks at random with the vermilion brush as instructed. The rest of the company did the same. I certainly supposed I was paying a shilling away—without any likelihood of seeing it again—for the opportunity of learning how the Chinese lottery men managed their little game. But next morning the sum of 29*l.* was handed over to the leader of our party, my share being 4*l.* 2*s.* 10*d.* The other case occurred at a bazaar in Boston, held in October 1873 by the Sisters of the Good Shepherd for a most excellent purpose. I bought tickets in a raffle for a gold watch, regarding their price as my contribution to the charity; but next morning a gentleman called in at the Parker House with the watch, which it seems I had won. I kept the watch, but preferred to pay the cost price, not caring to have my charity mixed up with anything so degrading, in my estimation, as gambling.

In England, lotteries at bazaars are still permitted, or rather are still winked at, for, strictly speaking, the law forbids them. Various magazines and journals also have lotteries more or less disguised, prizes being offered to purchasers of the serial who may make lucky guesses of various sorts. The law can hardly touch these cases, since the right to a guess is not ostensibly paid for, but thrown in, along with the serial itself, in return for the shilling, sixpence, twopence, or whatever the sum may be which the serial costs. But recently the law relating to lotteries has been broken in a singularly daring manner. A form of lottery which has long been in vogue on the continent of Europe (sometimes known as the Geneva system) has been reproduced in principle, or want of principle, though the details have been craftily altered in such sort that the system has an innocent, parlour-pastime aspect.

In the Geneva Lottery System (considered fully in my little book on "Chance and Luck") there are ninety numbers, and at a "drawing" five are taken out in succession at random. The public, before the drawing, have been entitled to buy a chance for any price, within certain limits, which they may like to pay. Thus a purchaser may take any one of the following chances:—(1) He names a single number of the ninety, receiving *fifteen* times his stake if his number is one among the five drawn; or (2) he names a single number and the position it is to occupy among the five drawn, receiving *seventy* times his stake if his guess is right; or (3) he names two numbers of the ninety, receiving *two hundred and seventy* times his stake if both appear among the five drawn; or (4) he names two numbers and their position, receiving *five thousand one hundred* times his stake if his guess is correct; or (5) he names three numbers of the ninety, receiving *five thousand five hundred* times his stake if all three appear among the five drawn; or (6) he names four numbers of the ninety, receiving *seventy-five thousand* times his stake if all four appear among the five drawn.

These ventures are called respectively, *simple* number, *determinate* number, *simple ambe*, *determinate ambe*, *simple terne*, and *simple quaterne*.

How much of rascality there is in the system will be seen from the following little table, showing the prize actually given and the prize which should have been given in each case, if the chances were properly dealt with as in a fair wager between man and man:—

TABLE SHOWING PRIZE ACTUALLY GIVEN AND PRIZE EARNED.

Venture.	Actual Prize.	Proper Prize.
Simple number . . .	15 times the stake	18 times the stake
Determinate number . .	70 " " "	90 " " "
Simple ambe . . .	270 " " "	400½ " " "
Determinate ambe . .	5,100 " " "	8,010 " " "
Simple terne . . .	5,500 " " "	11,748 " " "
Simple quaterne . . .	75,000 " " "	511,038 " " "

As the lottery-loving public always prefer to try for large prizes, not noticing how small the chances are of getting them, the more risky ventures in the above list were those chiefly taken, and it will be observed that these are the ventures for which the prizes are most inadequate. Thus, for simple terne, the total amount paid in prizes would in the long run be less than half ($\frac{5500}{11748}$) of the amount paid in; while for simple quaterne the total amount paid out would be less than $\frac{3}{20}$ of the amount paid in.

Of course the promoters of Continental lotteries on this system carefully published every case in which a great prize was won, knowing well that the general public would never guess the real significance of these cases. Every venture won on simple terne meant more than eleven thousand lost. Every venture won on simple quaterne meant more than five hundred thousand lost.

The recently invented plan depends on letters instead of numbers, but in principle is precisely the same as the Geneva system, and is worked on the same crafty and fraudulent lines. The promoters call themselves the "National Prize Competition Society"—the guessers are called "competitors," be it observed—and the scheme is advertised as "a novel system of money-making," the public fondly imagining that *they* are to make the money. The

plan is this: For sixpence any one can buy a ticket marked thus  , or sets of several tickets at a slight reduction, the average of the various prices being as nearly as possible five pence. On receiving a ticket the victim marks in a letter of the alphabet in each of the four divisions of his ticket, putting in any letter he likes. (The conditions say that *any* letter can be marked in in each square, so that the same letter, if the "competitor" pleases, might be marked in more than once; and as the "society" is similarly free to mark in any letter on each square, this possibility must be taken into account in considering the value of each probability.) The "competitor" posts his ticket, lettered according to his guessing, on Friday, and on the same day the "society" sends out to him by post a corresponding ticket, lettered as they please, so that his guess and their selection cross on their way.

If none of the competitor's letters correspond with the society's letters, he simply loses his sixpence. If one letter of his only is the same as the letter marked in the same square on the society's ticket, the competitor receives a shilling, or twice his stake. If two letters of his correspond with two, square for square, in the returned ticket, the competitor receives ten shillings. If three letters similarly correspond, the competitor receives 3*l.* or 5*l.*, according to the position of the squares thus correspondingly filled—a distinction for which there is no real reason so far as the probabilities are concerned: we may conveniently put 4*l.* as the average price paid for this triple success. Lastly, if all four squares are rightly lettered the "competitor" receives 100*l.*

Not one in a thousand probably of those who buy tickets in this lottery has any clear idea of the value of his chances for the respective prizes. The promoters of such schemes know this, though the Louisiana Lottery schemers daringly decline to clothe their iniquity, so confidently do they trust in the general idiocy of their victims. As a matter of fact, the calculation of the chances offered by the "National Prize Competition Society" is sufficiently simple. But those among the readers of these lines for whom it would be easy could make it for themselves, and those for whom it would not, could not easily follow any explanation; so I simply give the results.

Assuming the power of putting any letter whatsoever out of our English twenty-six on each square, there are 456,976 possible ways of filling in the ticket. Comparing these with any definite ticket filled in by the society, 390,625 will be wrong as to all letters; 62,500 will be right as to one letter; 3,750 will be right as to two letters; 100 will be right as to three letters; and *one* only will be right as to all four letters.

To determine the extent of the swindle, suppose these results, which represent the average proportions in any long series of trials, all duly paid for at the rates above mentioned, then there will be paid out:—

62,500*s.*	for single correct letters.	
37,500*s.*	for two	„ „
8,000*s.*	for three	„ „
2,000*s.*	for four	„ „
Total . 100,000*s.*	paid on prizes.	

The sum paid in, at 5*d.* for each of the 456,976 tickets, would be 190,407 shillings, and it is in this degree that the public, in purchasing large numbers of tickets on this plan, are wronged. That is, they pay 190,407 shillings, and get back on the average only 100,000 shillings on each set of 456,976 trials. But the promoters of the scheme have to pay one halfpenny for each ticket issued, and charge a penny for postage—according, at least, to their circular; so that they actually make 228,488 pence, or 19,041 shillings, more, by this seemingly slight overcharge for postage. At a moderate computation of the expense for printing tickets, advertising, &c., the "National Prize Competition Society" make the usual proportion of profit on the lottery they conduct, viz., between eighty and one hundred per cent! It is at this rate that the Louisiana Lottery Company get the better of their foolish victims. The Geneva, Hamburg, Brandenburg, and other lotteries, get similar gains.

The "National Prize Competition Society" advertise their lottery scheme as "a novel system of money-making"—and truly, in one sense. The deluded public suppose the money-making is for them, but the society attends to that part of the business, and, though the system is in reality old enough, yet it has been so clothed in a new garb that it takes in the weaker sort just as thoroughly as though it were altogether new.

How it has come to pass that, as I am told, the law has not yet stopped the "novel system of money-making," and punished the law-breakers, I know no more than I know how it comes to pass that respectable serials have permitted the "National Prize Competition Society" to advertise in their columns.

THE RELIGION OF THE ANCIENT BRITONS.*

PROFESSOR RHYS'S satirical reproach in his preface that "of course it is not pretended that anything connected with the history of religion among the Celts—or among the Teutons, if it comes to that—could vie in popularity with the pedigree of the last idol unearthed in the East, or even with the discovery of a new way of spelling Nebuchadnezzar's name," is fully warranted. For we have been indolently content to remain in shameful ignorance concerning the question of the religion of the races dominant in these islands before the Roman invasion. Our training, both at home and school, on Sundays as well as on week-days, has fostered this ignorance. Classical studies have usurped, and still unduly usurp, the scholar's time, as if all of value in the history of mankind is confined to a strip of Mediterranean seaboard. Romulus and Remus, Cecrops and Pisistratus, are familiar names to the student; perchance he has heard of Arthur, but not of Nud and Manannan MacLir. He knows the Iliad and the Odyssey, but not the songs of Edda and the breezy, bracing sagas, the Volsung and the Niblung, which, as William Morris says, "should be to all our race what the Tale of Troy was to the Greeks." And, in like manner, as the old artificial division of history into "profane" and "sacred" shows, instruction in the religious development of mankind rarely, except to point a false moral or a misleading contrast, passes beyond the age and races covered by the Bible.

For the larger number of folk, the political history of Britain begins with the invasion of Julius Cæsar, and its religious history with the mission of Augustine. Out of the material gathered by the famous emperor, as the result of personal observation, and by Tacitus, whose information was, however, secondhand, a few sentences describing the general features and mode of life of the "ancient Britons" were spun, and then the story of the successive invasions which resulted in the "making of England" was woven according to regulation pattern. Whether the wild tribes

* "Lectures on the Origin and Growth of Religion, as illustrated by Celtic Heathendom." By John Rhys, Professor of Celtic in the University of Oxford. (Williams & Norgate: 1888.)

of the northern and western parts, and the somewhat more advanced tribes of the southern parts, of the island were aborigines, and if not, whence they had come, and what was their relation to the races overspreading the northern hemisphere, concerning whom no written records exist; what remains, either tangible, as weapons of war and the chase, or intangible, as language, legend, myth, and custom were extant, neither historians nor antiquaries tarried to ask. What a vast and interesting, if obscure, field they left unexplored we are beginning to see, thanks to the industry and zeal of Professor Rhys and kindred labourers. The old indifference and ignorance, due not only to defects of education just referred to, but also to the delusion that "when Britain first at Heaven's command arose from out the azure main," she succeeded to the spiritual lordship and privileges which the Jews had forfeited,* and appeared equipped, Minerva-like, complete in all wisdom needful to eternal salvation, are giving place to the desire to know whether the course of man's progress in these islands runs parallel or not with that of other civilised races, and if so, what evidence is supplied by survivals.

It is as a contribution to this question that Professor Rhys's volume, in which the history of religion is for the first time comprehensively treated from the Celtic point of view, demands attention. Its somewhat late place in a valuable, if unequal, series itself illustrates our remarks on the tardy recognition of the importance of ancient British religions, but better late than never, and we will not lay reproach at the doors of the Hibbert Trustees, who are spending their money to good purpose.

Rarely has a more obscure and tough subject been taken in hand than this with which Professor Rhys bravely grapples, for the materials are not only scanty and scattered, but are often hard to interpret. They consist of a few references in ancient writers, and of inscriptions on votive tablets and other monuments preserved in local museums and described in transactions of provincial societies. Drawing primarily on Cæsar's account of the Gaulish religion, which may be taken as applicable to the religion of the British Celts, since they migrated from Gaul, Professor Rhys has sought to identify the Gaulish with the Roman Pantheon. He remarks that, "unfortunately for the study of Celtic religion and philology, few of the monuments of Gaul supply us with inscriptions in the national tongue; and probably all of them, whether in Gaulish or in Latin, date after the advent of the Roman conqueror and the initiation of his policy of assimilating the gods of vanquished Gaul with those of Rome. This policy took a very definite form under Augustus. He, as *pontifex maximus*, united the religions of the Roman world; but the manner in which Africa and the East were treated could not be recommended in the case of Gaul and Spain; so when he undertook to restore the position of the *Lares* and *Penates* he included among them the Gaulish divinities, who were henceforth styled *Augusti*. The result in each instance was that the name of the Gaulish god came to be treated more or less as a mere epithet to that of the Roman divinity, with which he began to be regarded as identical: thus the Gaulish Grannos became Apollo Grannus, and Belisama became Minerva Belisama, and so in other cases. . . . In a word, the Gaulish gods and goddesses were reduced in rank, and forced, so to say, to become more or less Roman; but they were not banished or in any way proscribed." The search for resemblances is justified not merely by the similar polytheistic stage of the conquering and the conquered races, but by their common, if remote, relationship, Celts and Romans being members of the scattered Aryan family. As illustrating the method adopted in this volume: when Cæsar speaks of the Gauls as making Mercury the inventor of arts, the patron of trades (as he was among the Romans) and of roads and journeys, Professor Rhys cites an inscription in which the god is described as Mercurio Aug. Artaio, the Gallic affix being cognate to the Celtic *ár*, plough-land. Again, Mars, god of war, is equated with the Gaulish god Caturix, a compound meaning king of war or lord of battle, tablets having been found near Geneva and elsewhere with this inscription, Marti Catur(igi), &c. Cæsar tells us that Mercury was worshipped as supreme, and the degradation of Mars, who was once the chief Celtic god, to the third place (Apollo being second) is, as Professor Rhys remarks, probably due to the progress of the people in the arts of peace.

How far the author has succeeded in his laborious attempt none but Celtic scholars can determine; and even were we competent to deliver judgment, our readers would resent the introduction of the abstruse and tedious matter which this would involve. They may share our reliance on the caution and accuracy which have thus far distinguished Professor Rhys's investigations, and may follow him with confidence through this labyrinth where lurk the disguised and disfigured gods whom our predecessors worshipped, and who have in many cases still further eluded us by becoming changed into the kings and heroes of romance. Certain it is that the Celts had their departmental deities, and that the characters of these were more or less akin to nature-gods of other polytheistic races. Among these stand out the Celtic Apollo, healing sun-god, Belenus, the reputed founder of Caerleon, and from whose name some derive Billingsgate; Aine or Aina, queen of heaven, mother of the gods; Taranis, god of thunder, to whom certain trees and plants are sacred; Manannan MacLir, a sun-god; Nodens, or Nud, and his *alter ego* Lir, sea-god, worshipped both in Britain and Ireland. During the Roman occupation a temple was erected to Nodens at Lydney on the Severn, his wife being the Irish goddess of the Boyne, while Lud, whose name reappears in Shakespeare's "Lear," and whose daughter figures in Celtic romance, perhaps survives among us in London, if that name be not, as some antiquaries think, derived from Llyn-Din, the "lake-fort." Upon this Professor Rhys has the interesting remark that "the association of Llûd, or 'King Lud,' as he has come to be called in English, with London, is apparently founded on a certain amount of fact: one of the Welsh names for London is Caer-Lûd or Lud's Fort, and if this is open to the suspicion of having been suggested first by Geoffrey, that can hardly be supposed possible in the case of the English name of *Ludgate* Hill. The probability is that as a temple on a hill near the Severn associated him with that river in the west, so a still more ambitious temple on a hill connected him with the Thames in the east; and as an aggressive creed can hardly signalise its conquests more effectually than by appropriating the fanes of the retreating faith, no site could be guessed with more probability to have been sacred to the Celtic Zeus than the eminence on which the dome of St. Paul's now rears its magnificent form."

But besides the major gods of the Celtic Pantheon, there is a crowd of *dii minores*, both native and borrowed, spirits of forests, springs, and rivers, which last had their own special divinities, as shown in the Dee and other streams with kindred names. The mountains were dedicated to airy powers; every village was protected by the

* A delusion of course rampant among the eccentries who believe in the descent of Britons from the lost Ten Tribes, and who identify the British Lion with the Lion of the Tribe of Judah! As showing the prevalence of this craze, the Catalogue in the Subject-Index of Modern Works issued by the British Museum gives thirty-two books on the identity of Britain with Israel published between 1882 and 1886.

"mothers," or guardian spirits, who appear in mediæval legends as the White Ladies, the three fairies, the weird sisters, the wild women of the woods; while in the giants and dwarfs and the fairies and goodies of nursery legend other minor deities reappear. Forming a dark background to this spritely company, we find another and older creed, familiar to us as Druidism, concerning which the most foolish speculations and bizarre theories have been broached. Upon this Professor Rhys has much to say which is of interest, and in connection with which we advise the perusal of his little book on "Celtic Britain,"* as also of the chapter on the religion of the British tribes in Mr. Elton's scholarly and delightful "Origins of English History."† As this latter book is out of print, it may be well to quote the opening sentence from Mr. Elton's fine chapter:—

> The religion of the British tribes has exercised an important influence upon literature. The mediæval romances and the legends which stood for history are full of the "fair humanities" and figures of its bright mythology. The elemental powers of earth and fire, and the spirits which haunted the waves and streams, appear again as kings in the Irish annals, or as saints and hermits in Wales. The Knights of the Round Table, Sir Kay and Tristram, and the bold Sir Bedivere, betray their divine origin by the attributes which they retained as heroes of romance. It was a goddess, *Dea quædam phantastica*, who bore the wounded Arthur to the peaceful valley. "There was little sunlight on its woods and streams, and the nights were dark and gloomy for want of the moon and stars." This is the country of Oberon and of Sir Huon de Bourdeaux. It is the dreamy forest of Arden. In an older mythology it was the realm of a King of Shadows, the country of "Gwyn ab Nudd," who rode as Sir Guyon in the "Faerie Queene,"
>
> And knighthood took of good Sir Huon's hand,
> When with King Oberon he came to Fairyland.
>
> The history of the Celtic religions has been obscured by many false theories which need not be discussed in detail. The traces of revealed religion were discovered by the Benedictine historians in the doctrines attributed to the Druids; if the Gauls adored the oak-tree, it could only be a remembrance of the plains of Mamre: if they slew a prisoner on a block of unhewn stone, it must have been in deference to a precept of Moses. A school pretending to a deeper philosophy invented for the Druids the mission of preserving monotheism in the West. In the teaching of another school the Druids are credited with the learning of Phœnicia and Egypt. The mysteries of the "Thrice-great Hermes" were transported to the northern oak-forests, and every difficulty was solved as it rose by a reference to Baal or Moloch. The lines and circles of standing stones became the signs of a worship of snakes and dragons. The ruined cromlech was mistaken for an altar of sacrifice with the rock basin to catch the victim's blood and a holed-stone for the rope to bind his limbs.

In inquiring into the origin and nature of Druidism, it is necessary to have a clear idea of the succession of races in Britain prior to the Roman invasion. We may leave out of this list the men of Palæolithic times who ranged the country under a more or less arctic climate, waging war against the huge mammals of the Quaternary epoch, and whose chipped tools and weapons are found in the river-drifts and under cavern floors, for it is certain that no continuity of race can be proved between these savages and any tribe or nation now found in North-Western Europe.

Between their disappearance and the arrival of a more advanced race great physical changes occurred, Britain having been submerged, then raised, reunited to the Continent, and then finally separated. But the Britain of Neolithic and far later times, down to a period long subsequent to the Roman invasion, was, in its superficial features, not the Britain of to-day, but a land of fen and forest, the highways through which determined the ancient boundaries of its several kingdoms. Despite Mr. Ruskin's Jeremiads on the degradation of the climate of England through the blotting out of her skies with "Manchester's devil darkness, and sulphurous chimney-pot vomit," and of the troubling, not as by the angel at Bethesda, of her streams with the pollution and filth of her factories, we are in much better case now than then. When the legions of Cæsar first disembarked they found the island little better in most parts than "a cold and watery desert. According to all the accounts of the early travellers the sky was stormy and obscured by continual rain, the air chilly even in summer, and the sun during the finest weather had little power to disperse the steaming mists. The trees gathered and condensed the rain; the crops grew rankly, but ripened slowly, for the ground and the atmosphere were alike over-loaded with moisture. The fallen timber obstructed the streams, the rivers were squandered in the reedy morasses, and only the downs and hill-tops rose above the perpetual tracts of wood." The herds of mammoths, rhinoceroses, and other pachyderms; the cave-lions, cave-bears, hyænas, and other beasts of prey, that had roamed through the jungles and wallowed in the rivers during the alternating polar and tropical climates of the Old Stone Age, had vanished, and in their place wild boars and oxen (the *urus* of Cæsar), elks and other animals, for the most part extinct, tenanted the forests and swamps. Wolves prowled over the long desert that stretched from the Cheviots to the Peak; beavers built in the streams; and only the cry of the cormorant and other sea birds broke the silence that reigned over the expanse of peat-bog that stretched inland on the west, over the swamps of the midlands, and over the dreary fens that spread in monotonous flatness eastwards. Masses of forest so dense as to be in some districts impenetrable, stretching, as did the Andredsweald, one hundred and twenty miles, with wide expanses of moor and swamp, that surrounding the higher ground where Ely Cathedral now stands exceeding sixty miles across; narrow strips of arable, and wider breadths of pasture land, spread over the estuaries and across the inland valleys—such, broadly outlined, were the features of England from pre-Roman times till a thousand years later, despite much that had been accomplished by the military spirit of the Romans and the industrious energy of the Saxons, whose work the Norman, with his passion for the chase, undid so ruthlessly.

This description of the physical aspect of our island applies still more to the Neolithic age, when no Aryan husbandman had yet struck his plough into the soil, or burned the timber into charcoal for the smelting of the abundant ore. The earliest known Neolithic settlers in Britain were a short and thickset people, with long or oval heads, dark hair, probably swarthy complexions, aquiline noses, long narrow foreheads, and with the tibia or shinbone presenting in many cases that flattened, sabre-like form, called platycnemia—a feature not so much indicative of ape-like ancestry as of physical change due to the freer and more constant use of certain muscles which are brought into action in hunting game on foot, and such-like occupations. These people, the Kynesii, of whom Herodotus speaks as dwelling outside the Pillars of Hercules, furthest away towards the setting of the sun, are now generally identified with the remnants of non-Aryans known to us as Iberians, found in various parts of Europe, descendants of the wide-spread race whose relics—tombs, and stone circles marking the transition from burial-place to temple—exist by thousands in both hemispheres. Notable among these remnants are the Basques, living in the Western Pyrenees, and speaking a relatively modern language which is the sole survivor of the Iberian family of speech, and, so far as is known, without affinity with any other language in the world. But it is obvious that unless the untenable and indolent theories

* Published by S.P.C.K. London. 1882.
† London: B. Quaritch. 1882.

of some historians respecting the universal extermination of subject races in these islands be accepted, some traces of such a folk are not to be confined to the Basque district, and in proof of this we have indications of their presence nearer home. There are in many parts of Ireland, of the Highlands of Scotland, and the Western Isles, traces by no means infrequent of a short, black-haired, long-headed stock, described as having a strange foreign look, of whom the late Mr. Campbell of Islay, in his remarkable collection of tales gathered orally in the West Highlands, gives a typical example. He says, "Behind the fire sat a girl with one of those strange foreign faces which are occasionally to be seen in the Western Isles—a face which reminded me of the Nineveh sculptures and of faces seen in St. Sebastian. Her hair was as black as night, and her clear dark eyes glittered through the peat smoke. Her complexion was dark, and her features so unlike those who sat about her that I asked if she were a native of the island, and learned that she was a Highland girl."* Neither is the swarthy type absent from England and Wales, not only in ancient Siluria (comprising Glamorganshire, Brecknock, Monmouth, &c.), but in some parts of East Anglia, also in the south-west, and even in the Midland Counties, in which last, with their traces of the predominant influence of the Saxon and Danish conquerors, we might expect to find only a fair-haired and light-complexioned folk. "When we consider the many invasions of strangers, and the oscillations to and fro of different peoples, it is impossible not to realise the strange persistence of the race. Through all the troubles which followed the conquest of Gaul by Cæsar, and of Britain by Claudius, through all the terrible events which accompanied the downfall of the Roman Empire, causing the Britons to be exterminated over a large part of England, and the almost total extinction of the ancient type of Roman in Italy, the Iberian lived, and still is found in his ancient seats, with physique scarcely altered, and offering a strong contrast to the fair-haired Celtic, Belgic, and German invaders. The Iberian race is known to the ethnologist and historian merely in fragments, sundered from each other by many invasions and settlements of the Aryan race. It is shown by the researches into caves and tombs to have been in possession of the whole of Europe north and west of the Rhine in the Neolithic age, and has been traced by Dr. Virchow into Germany and Denmark."† Next in succession to it is the Celtic immigration, the invasion of Britain by tall, round-headed, fair-haired, large-limbed men, bringing with them a mighty motor power in human progress in their knowledge of the use of the metal bronze which they had acquired along the route. These Celts were divided into two groups, the one, and the earliest to cross the sea and repeat the conquest of Gaul in the conquest of Britain, being the Gaidhelic or Gaelic, formerly written by themselves Goidel. From this branch, the Goidelic, are descended the people in Ireland, the Isle of Man, and the Northern Highlands, who speak Gaelic. The second group, the Brythonic, from Brython, the Welsh form of Briton, are the ancestors of the Welsh people and the Britons, the ancient Gauls being also included with them, since the Brythons were Gauls who came over to settle here. To one of these two branches every Celt belongs.

The remains of these Celtic and of the pre-Celtic peoples indicate what befell the latter. The round barrows of the wolds of Yorkshire contain about an equal proportion of the skeletons of long-shaped and round-shaped skulls, pointing to intermarriage and generally friendly relations between the two; but in the southern parts of the island the round-headed type is dominant, pointing to the expulsion of the pre-Celtic.

(*To be concluded.*)

* "Tales of the West Highlands," iii. 144.

† Boyd Dawkins's "Early Man in Britain," p. 331.

Reviews.

Emin Pasha in Central Africa. Being a Collection of his Letters and Journals. Translated by Mrs. R. W. FELKIN. (Geo. Philip & Sons.)—Pending the arrival of Stanley's relief expedition the world is longing to know all it can about the brave and unselfish Emin, and his friends have exercised a wise discretion in publishing the letters and extracts from journals which he has sent to various correspondents during the past ten years. To future generations, when time shall have given its truer proportion to events which are yet too near us for right focus, there will, we think, be no more striking and dramatic figures of our day than Gordon at Khartûm and his trusted friend Emin, who happily survives to maintain firm and bloodless rule in Central Africa, protecting his people from the slave-hunter, and refusing to desert them at the prospect of approaching relief. In the last letter which this book gives, dated Wadelai, April 17, 1887, he tells Dr. Felkin that he will not leave his post. "If the people in Great Britain think that as soon as Stanley or Thomson comes I shall return with them, they greatly err. I have passed twelve years of my life here, and would it be right of me to desert my post as soon as the opening for escape presented itself? For twelve long years I have striven and toiled, and sown the seeds for future harvests, laid down the foundation-stones for future buildings. Shall I now give up the work because a way may soon open to the coast? Never . . . All we would ask England to do is to bring about a better understanding with Uganda, and to provide us with a free and safe way to the coast. This is all we want. Evacuate our territory? Certainly not!"* And this is the man to whom our late poltroon Government permitted the Egyptian Government to "give the sack," to put it plainly, in the early part of 1886. "It is," Emin says, "a cool business despatch in the fullest sense of the term, not acknowledging by a single word the cares I have borne for three years, my fights with Dangola and negroes, my hunger and nakedness, not giving me a word of encouragement in the superhuman task of leading home the soldiers, which now lies before me. However, I am accustomed to this sort of thing. In the years 1878-80, during which the river was blocked for twenty-two months, I held the country and people together, and showed for the first time that we could maintain ourselves by our own strength without any supplies from Khartûm, and not only did I spare the Government expense at this time, but also proved practically that the province could, under an honest administration, yield a surplus. . . . Yet, who has given me even a word?" Emin, "the Faithful" (faith justified by works, in this case) is the Turkish name which, to smooth his intercourse with the Mohammedans, was adopted by Eduard Schnitzer, who was born in 1840 at Oppeln in Silesia. He became a student of medicine, and his passion for travel and love of natural history carried him to Turkey, where he procured an appointment on the staff of the Vali of Asia Minor, and ultimately entered the Egyptian service, being sent to Khartûm, and thence, as the chief medical officer of the Equatorial province, of which

* Since this notice was written, a letter appears in the *Times* of April 10, under date Wadelai, August 16, 1887, from Emin Pasha, expressing the same firm resolve.

Gordon was governor. The two men became fast friends; and when Gordon was appointed Governor-General of the Soudan he promoted Emin as governor of the Equatorial province, which extends from nine degrees to two degrees north of the equator. A clear and indispensable map, which Mr. Ravenstein has engraved for this volume, enables the reader to follow with ease the various journeys described. It is the record of these visits to the different parts of his province that the letters and journals mainly embody, and they supply a vivid and interesting narrative of the incessant and varied work which Emin has carried on in the face of stupendous difficulty, danger, and discouragement. While engaged in raising and drilling troops, substituting native for Egyptian soldiers, promoting trade, encouraging cultivation of coffee, indigo, cotton, and other products, adding large districts to his territory, not by war, but by skilful negotiation, converting a deficit of over 30,000*l.* into a surplus of 8,000*l.*, Emin has also found time to make extensive observations on the geology and general features of the province, to form large collections of its plants and animals, and to gather copious details concerning the manners, customs, and beliefs of its various tribes, notably of the Monbuttus, a cannibal, but, in many respects, advanced race, to whom he devotes a special section (pp. 186–213). Despite a good deal of inevitable repetition and of sameness in details, the letters and journals deserve to be read without skipping, a task the more easy because their translation has been so skilfully done by the wife of Emin's missionary friend, Dr. Felkin, that they read as smoothly as if the originals had been written in English.

Geology: Chemical, Physical, and Stratigraphical. By Joseph Prestwich, Professor of Geology in the University of Oxford. Vol. II. (Clarendon Press.)—This volume completes the important work into which the ripe results of fifty years' study of the science at which the Oxford professor has laboured *con amore* are gathered, and it is from cover to cover worthy of his high reputation. We notice that the publishers give prominence in the advertisements of this book to the advocacy of "the non-uniformitarian views of geology" by its distinguished author, but surely he can be no party to the sounding of this note of challenge, since his attitude is not that of the defiant extremist which that implies. The day is happily past when the scientist is sunk in the partisan, for the differences between contending schools are often found to be rather of terms than of principles. Because Lyell, after careful sifting of evidence, abandoned the old catastrophism and argued from the ascertained operations of existing causes, that the same causes, allowing for variation of degree, have sufficed to bring about past changes, a host of purblind followers have contended for an unalterable uniformitarianism. It is against such extreme applications of the doctrine that Professor Prestwich contends when he says that "while the laws of chemistry and physics are unchangeable, and as permanent as the material universe itself, the exhibition of the consequences of those laws in their operation on the earth has been, as new conditions and new combinations successively arose in the course of its long geological history, one of constant variation in degree and intensity of action."* Perhaps the word "constant" implies more than we are prepared to admit, but, as Professor Huxley remarked in his anniversary address to the Geological Society in 1869 on Geological Reform, "there appears to be no sort of necessary theoretical antagonism between Catastrophism and Uniformitarianism. On the contrary, it is very conceivable that catastrophes may be part and parcel of uniformity." And he illustrates his meaning by the working of a clock, the good time-keeping of which means uniformity of action. "But the striking of the clock is essentially a catastrophe; the hammer might be made to blow up a barrel of gunpowder or turn a deluge of water; and, by proper arrangement, the clock, instead of marking the hours, might strike at all sorts of irregular periods, never twice alike, in the intervals, force, or number of its blows. Nevertheless, all these irregular, and apparently lawless, catastrophes would be the result of an absolutely uniformitarian action, and we might have two schools of clock theorists, one studying the hammer, and the other the pendulum." In his first volume Professor Prestwich dealt with the nature and distribution of the materials forming the crust of the earth, and with the several agencies by which, in the remodelling of these materials, the stratified have been developed from the unstratified rocks. The present volume treats of the original condition of that crust, of its anatomy, history, and organic contents, and concludes with a discussion of those abstract physical and cosmical problems which relate to the evolution of the globe and of the system to which it belongs. The distinctive feature of the author's treatment of the stratigraphical branch of his subject is in his insistance on the impossibility of any universal scheme of classification, the formations in distant areas being correlated not by identity of species, but by the presence of the same characteristic genera, the large community of which amongst the Invertebrata everywhere is most striking. He remarks that "the great time-divisions are of almost universal application, but the smaller 'breaks in continuity,' which are of frequent occurrence in all areas, are subject to constant differences of extent and value; consequently, in filling up the details of the several geographical areas, each one is found to have its own local stamp, and possess its own special terms, some knowledge of which is as essential to the geologist as is the language of a country to the traveller, if he would pass through it with profit" (p. 3). As novel and informing commentary on this, we have several tables of classification showing the equivalent strata in various parts of Europe, and in America, Asia, Africa, and Australasia, with brief "lists of the characteristic genera of plants and animals attached for the purpose of showing the distribution of some of the more important life-forms over the globe at the several contemporaneous epochs." Altogether, the space given to the geology of other countries is a unique and valuable feature of the volume. Convenient summaries of the faunas and floras of each period are supplied, so that a great mass of facts is helpfully grouped for easier grasp by the student, for whom also an abundance of excellent plates and woodcuts, together with a geological map of Europe, are provided. In the chapter on the Quaternary or Pleistocene period, to our knowledge of which the author's researches have largely added, some remarks on the place of man in the geological record are included, and it is significant of a turn in the tide to find Professor Prestwich admitting the probability of man's existence in North-Western Europe in the glacial epoch, the duration of which he thinks may not have been longer than from 15,000 to 25,000 years. This is in keeping with the generally shorter estimates of time than are usually demanded by geologists which characterise the volume, and so far paves the way for reconciliation between geologists and physicists.

Chambers's Encyclopædia. Vol. I., A to Beaufort. (W. & R. Chambers. 1888.)—The publishers remind us in their preface that their great work has been before the world in complete form for twenty years. Revision has gone on at frequent intervals, but the time has arrived for an entire recast of the matter, involving the rewriting of a large proportion, so as to bring down the information to date. So far the work has been well and thoroughly done;

* Vol. i. p. vi.

and never did an undertaking more nobly redeem the promise of its preface than this first volume of the new edition, which, for the convenience of the many, is also under issue in monthly parts. Even to the few who can afford to buy the bulky "Encyclopædia Britannica" this moderate sized and cheap companion is as indispensable as the "finder" to a big telescope. Not relying solely on authorities whose names might justify our taking their contributions on trust, we have gone over the majority of the articles with considerable care, and the result warrants the highest praise that we can give. Mr. Grant Allen's article on Anthropology is a masterly and lucid survey of the science: the cognate articles on Animism, Animal- and Ancestor-Worship are models of brevity and clearness, while including material for the reader to form his own judgment on Herbert Spencer's and opposing theories; the article Ballad, by the same skilful hand, has had the advantage of revision by Andrew Lang and others. Professor Tait's article on the Atom supplies, *inter alia*, an untechnical account of the periodic law of the elements; the article on Matthew Arnold —now, we must sorrowfully add, gone to his rest— seizes in a few words the characteristics of his work both in prose and verse; while among the contributions from the United States, the insertion of which happily protects the work from Transatlantic thieves, we must single out as especially complete and interesting Dr. Greene's article on the American Indians. *Per contra*, under Animal, the writer, in speaking of the presence of chlorophyll in certain infusorians and other invertebrates, overlooks Sach's explanation that it is not a proper constituent of their bodies, but due to the presence of vegetable cells which they assimilate; under archæology, Dr. Anderson has not sufficiently insisted on the totally unlike conditions and characters of the Palæolithic and succeeding ages; the discovery of a deep sea Ascidian (*Octanemus Bythius*) by the *Challenger* expedition might have been noted in the article under that heading, and the article on the Aryans will soon need considerable revision. To descend to trifling errors, "Robert Maitland" should be "Thomas Maitland" in the article on Anonymons. We should add that the maps, which are both political and physical, and also the woodcuts, are very superior to those given in the old editions, and that the typography is perfect.

Marahuna: a Romance. By H. B. MARRIOTT WATSON. (Longmans.)—We think this story marks the approaching exhaustion of the modern romantic school, to which Hugh Conway's and Rider Haggard's tales gave chief impetus. It was an inevitable reaction from the colourless, analytical, white-of-egg flavoured studies of Howell and James, making any change of diet welcome to the confirmed novel-reader. Not that this book lacks an original side, but that the combinations are limited and the surprises discounted. The talk on shipboard is too "high-falutin'," and Marahuna herself inspires languid interest, the only quality in her which gives force to the character is akin to that which Grant Allen presents so powerfully in "For Maimie's Sake." The scenes of the story alternate between the Antarctic circle and Hampshire; the origin and fate of Marahuna our readers must learn from the book itself.

Civilisation and Progress. By JOHN BEATTIE CROZIER. New edition. (London: Longmans & Co. 1888.)—No one can rise from the perusal of the work whose title heads this notice without the conviction that its author has established a claim to stand high among the most profound and original thinkers of the day. He has set himself an ambitious task, and he has very narrowly indeed escaped entire success. In his search for a consistent theory of civilisation and progress, Mr. Crozier successively discards the historical, the metaphysical, and the psychological methods, and founds his own new organon on "the laws of the human mind in its entirety as a concrete unity"—an elastic definition which crops up, as a *deus ex machinâ*, throughout the work. That such laws are immutable is taken for granted. Portions of the work before us must irresistibly attract the reader. We may instance chapter vii. of Part. I. and the whole of Part IV. among them. But the man who sets himself to frame a new method for the investigation of the factors and causes operative in the advancement of the human race should above all things be impartial, and this our author assuredly is not. His unreasoning admiration of democracy in the abstract to a large extent blinds him entirely to its operation in the concrete. Certainly his picture of America is evolved from the depths of his own moral consciousness. Everyone personally familiar with the United States knows that politics there are practically abandoned to the scum and dregs of the population, and that an American *gentleman* (and there is an upper class even in Mr. Crozier's model Republic) repudiates with scorn and loathing the slightest sympathy or fellowship with the caucus-mongers, log-rollers, and wire-pullers who dominate all political matters whatsoever there. A great many hard things have been written and said about the Corporation of the City of London, but Mr. Bottomley Firth himself would scarcely dare to insinuate the possibility that the Lord Mayor and Aldermen could ever be guilty of the infamous corruption and peculation of which the municipal authorities of New York were convicted at a comparatively recent date. As for current French Republicanism, no further reference is needed to it here. When evolution shall have developed a superior type of the human race, Mr. Crozier's supposititious Republic may become an accomplished fact: at present "the laws of the human mind," as known to us in their outward manifestations, present an insuperable bar to the realisation of his Utopian dream. The constitution of a country may confer political equality upon every one of its citizens; but to suppose that they can or ever will become socially equal is as reasonable as to imagine that their height or the colour of their eyes can be regulated by a statute. *Malgré* the small display of fanaticism which has elicited these remarks, the author of "Civilisation and Progress" has produced a work of very high merit, and one which will repay perusal and reperusal.

The English in the West Indies; or, the Bow of Ulysses. By J. A. FROUDE. (Longmans.)—In the present work Mr. Froude gives us the result of his acquaintance with a very different batch of colonies from those which formed the subject of his brilliant sketches in "Oceana." If it lacks the freshness and vigour of that book, drawn as these qualities were from the material dealt with, it has a more romantic flavour, mixed with bitterness at the neglect which has allowed whilom bright jewels in the possession of the Crown to become dull and tarnished, or, as the author in repeated metaphor says, the bow of Ulysses to remain unstrung. In his own matchless prose Mr. Froude tells how the Caribbean Sea, from Trinidad to Jamaica, was the cradle of our naval empire, the scene of exploits to furnish the most stirring cantos if ever England's victories on the seas are done into an epic poem. All the romance of adventure and conquest in the New World defiles before us; every hero, from Columbus to Drake and Rodney, is there, "the captains of the ships and all the ships in order." But the main subject of the book is the West Indies of to-day, with the problems of England's position towards the decreasing white and the increasing black populations, which our party leaders, miscalled statesmen, ignoring inherent differences in the capacity and power of self-

control of races of mankind, have aggravated by their exportation of parodies of the mother institutions—household suffrage, representative assemblies, and so forth. They have ignored the fact that the personal relations between master and servant have ceased to exist with the abolition of slavery, and that the political elevation of the negro has done, and can do, nothing to establish new relations. We must confess that Mr. Froude, although paradoxical as ever, makes out a strong case for the government of those islands as Crown colonies. No tinkering with their political constitution can arrest the decay of their staple industry—sugar; capital and enterprise can only be tempted to remain in Jamaica, Dominica, and other suffering islands, or be attracted thither anew and be engaged in remunerative channels, by the firm rule of white over black. Let the superior race withdraw, and the negro populations will relapse into barbarism, with its revolting superstitions, cannibalism, devil-worship, &c., as they have in Hayti. We have said enough to indicate that, as a contribution to the mode in which the mother-country is to discharge her duty to these neglected, but lovely and fertile, islands of the West Indies, Mr. Froude's book demands serious perusal.

Juvenal in Piccadilly. By Oxoniensis. (Vizetelly & Co.)—Satires seem almost anachronisms nowadays. Since Alfred Austin published his "Season" we do not remember one that has appeared to lash the humours and follies of the town until the present brochure, which, free from the exaggerated tones of the great Roman, finds material for its crisp and brightly-written verse in vices and affectations which have changed their zone but not their nature.

Messrs. Blackwood & Sons send us a new and almost entirely rewritten edition of the late Professor David Page's *Introductory Text-Book of Geology*, the merits of which need "no bush" from us; from Messrs. Smith & Elder we have Volume XIV. of their noble *Dictionary of National Biography*, comprising Damon to D'Eyncourt, and therefore including the famous name of Darwin, the article on whom is fitly from the pen of his son and biographer; amongst current serials we have to acknowledge the *Westminster Review*, containing a delightfully fresh paper on Heine; the *Century*, the *Cyclopædia of Education*, *Longmans*, in which appears Mr. Besant's important paper on making provision for girls; and *Baby, an Illustrated Magazine for Mothers*, which, we hope, will be received by them as its prospectus says it has been received by the press—"with open arms."

The author of *Sunlight* (reviewed on p. 140) complains that we represent him as explaining gravitation by the action of light, whereas he only stated that light "developed" gravitation. He further objects to a quotation from his volume anent meteorites being earthy atoms separated from the air by cold pressure and vegetation. What he meant was that by "the death and decomposition of Fauna and Flora their dusts do rise, and may become constituents of meteorites when separated from the air by cold pressure" (!). We trust that our readers will appreciate the value of these corrections, and judge how far they affect the validity of our original judgment on the book in connection with which we have been asked to make them.

Our Whist Column.

By "Five of Clubs."

MAKING THAT LITTLE TRUMP.

THE other evening two Bumblepuppists, playing as partners against two sound but not specially brilliant players, distinguished themselves in the following triumphant manner:—

THE HANDS.

B { C. (*trumps*).—K, Kn, 6. H.—A, 6, 5, 2. / D.—Q, 10. S.—A, Q, 9, 6. }

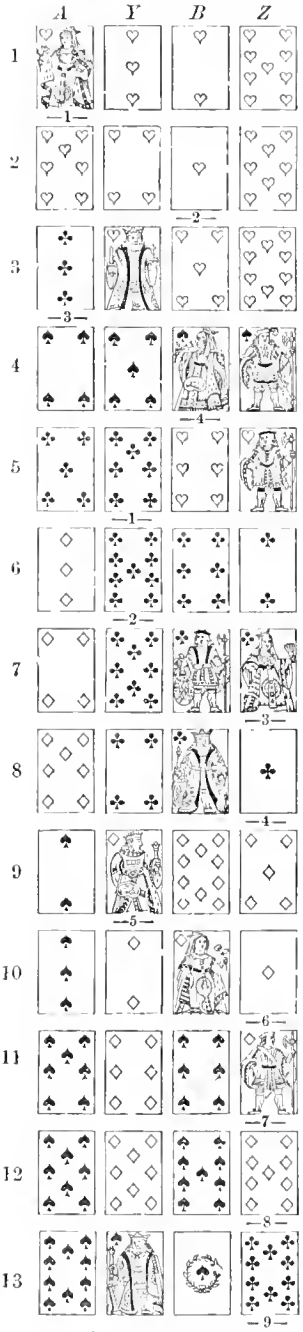
Y { C. (*tps*).—9, 8, 7, 4. / D.—K, 8, 6, 2. / S.—K, 5. / H.—K, 4, 3. } Z { C. (*tps*).—A, Q, 10, 2. / D.—A, Kn, 9, 5. / S.—Kn. / H.—Kn, 10, 9, 8. }

B / Y Z / *Tr.* C. 10 / A leads.

A { C. (*trumps*).—5, 3. H.—Q, 7. / D.—7, 4, 3. S.—10, 8, 7, 4, 3, 2. }

Score:—A B love; Y Z 2.

Card underlined wins trick; card underneath leads next.



Y Z win three by cards.

NOTES.

1. A sees no other chance of making a trick or two from his own hand but by ruffing Hearts. He therefore leads the Queen. Y follows the system now generally approved, and does not put an honour on an honour. Z begins a signal, hardly justified with one suit so weak; but the double tenace in trumps makes it desirable that Z should not himself have to lead trumps. Moreover, Z knows from his own Hearts that A has led from weakness, with a probable view to ruffing.

2 and 3. A's lead could hardly have better served his purpose if he had had the arranging of the Hearts in the other hands. The little trump is not only made, but it kills the Heart King.

4. A now opens his long suit, after getting rid of the one card which would have given him any chance of re-entering if (as is by no means unlikely) the suit is quickly established.

5. Of course B should have forced Z's strong trump hand with the Spade Ace. But B has not noticed the signal; and if he had, he would not have known what to do about it. What his reason was for leading Hearts when he must have known that he was giving Z the tenace by so doing, it would be difficult to say. (That is the worst of weak players; one can seldom imagine their reason even when they have one, but they generally have none.)

6, 7, and 8. Of course Y leads his best trump, and Z, knowing A's weakness, passes the Nine. B is again led through, and Z then draws the trump King.

9, 10, &c. The rest of the game plays itself.

As Z threw down his last three cards, all winning ones, A remarked to B, "Lucky I played as I did!" To which B responded, "Yes, we got two tricks by it, though we were too weak to save the game; isn't that so?" turning to Z. "Hardly," said Z, "you not only did not make two tricks you would otherwise have lost, but you lost one trick at least you would otherwise have made; so that your play really lost you the game and the rubber. This neither A nor B would believe, till Y Z rearranged the cards, and, placing them face upwards on the table, showed that sound play (independently, of course, of any know-

ledge already obtained about the cards) would have given the following result:—

A	Y	B	Z		A	Y	B	Z
1.—S 4	S 5	S Q	S Kn		8.—D 3	D K	D 10	D 5
		—1—				—5—		
2.—S 2	S K	S A	C 2		9.—D 4	D 6	C 6	D 9
			1—				1—	
3.—H Q	H K	H A	H Kn		10.—S 3	D 8	S 6	C 10
		—2—						—6—
4.—H 7	H 3	H 2	H 8		11.—S 7	C 8	C Kn	D Kn
			2—				—5—	
5.—C 3	H 4	H 6	H 10		12.—S 8	C 4	S 9	C Q
—3—								—7
6.—D 7	D 2	D Q	D A		13.—S 9	C 9	C K	C A
			—3—					—8—
7.—C 5	C 7	H 5	H 9					
	—4—							

Y Z make only two by cards. As it chanced, the treble made by Y Z completed a rubber, so that the extra point which A B's bad play gave Y Z made a considerable difference in the score for the evening

Our Chess Column.

By "Mephisto."

OME time back, at the Divan, Mr. Blackburne was made the victim of the severe criticisms and strictures of one of those professors of "the art of problem construction," who make problems, solve problems, and judge problems according to strict rules and canons. Herr Spitzler is not satisfied with a mere effort of the imagination conceiving a pretty idea and shaping it into problem form; he has æsthetic notions about "beauty of construction," "economy of force," "difficulty," "originality," "purity," "harmony," &c., and unless a composition can stand all these tests, the Professor does not think much of it. Accordingly, when Mr. Blackburne, speaking of his own powers of blindfold play, showed some end-games which he brought to a happy termination *sans voir*, though playing eight games at the same time, one or two simple individuals expressed their surprise at such brilliant performances. Not so, however, the Professor, for, said he, "Speaking of end-games generally as played by great players, I do not think there is any cause for great admiration. In most instances a mate is accomplished by brute force, and though a piece or two may be sacrificed, yet the object is the same—to force mate in a few moves by a most direct method, check, check, check, and mate. Compared with a fine problem," he said, "the best end-game played is but a clumsy and raw production. I have never yet seen a mate forced in an end-game by a quiet and non-threatening move, which makes problems so beautiful."

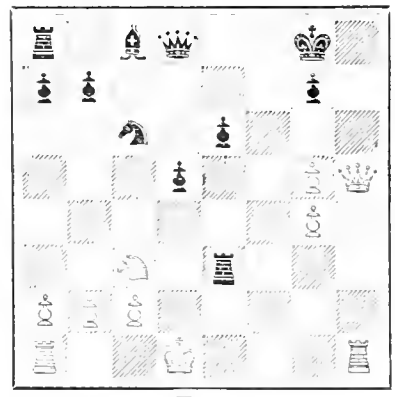
"Well," said a well-known chess editor, "I think I can show that Professor Spitzler is wrong in his basis of comparison between end-games and problems, and his consequent strictures. For the sake of comparison, let me ask you whom would you think the greater general, the commander who wins an actual battle in the field by rough though clever and bold manœuvres; or the staff officer who, in imitation of this event, works out a scheme which he puts into execution on the parade ground, when, as a result of a sham fight, both armies being like clay in his hands, he wins a battle with greater 'brilliance,' 'economy of force,' 'difficulty,' 'harmony,' and 'purity of manœuvring'?" And as for the assertion that the quiet move is never found in practical end-play, I can contradict that by a game just received by the American mail, which was played only last month by Steinitz at Havanna. Here it is:—

1. P to K4	1. P to K3
2. P to Q4	2. P to Q4
3. QKt to B3	3. KKt to B3
4. P to K5	4. KKt to Q2
5. P to B4	5. P to QB4
6. P × P	6. B × P
7. Kt to B3	7. Castles
8. B to Q3	8. QKt to B3
9. P to KR4	9. P to B3
10. Kt to KKt5 !	

To bring about an end-game by such means in actual play is a different thing from making a problem.

10.	10. P × Kt
11. B × P (ch) !	11. K × B
12. P × P (disc ch)	12. K to Ktsq
13. Q to B5	13. Kt(Q2) × P
14. P × Kt	14. R to B1
15. P to KKt4	15. R × KP (ch)
16. K to Qsq	16. B to K6
17. B × B	17. R × B

YOLMAYO.
BLACK.



WHITE.
STEINITZ.

Now the Professor was challenged to find the decisive move, but in spite of numerous and prolonged attempts, he failed to do so, which only proves, said the editor, that you were wrong in saying that winning moves in actual end-games are more or less obvious, because forcible, and never quiet. Steinitz now played the very quiet move of 18. Kt to Kt5, which is decisive, and equal to any similar move in a problem, but infinitely more meritorious. The object of this move is to cut off the retreat of the King. White threatens P to Kt6. Black cannot play his Kt to K4, for he loses the Queen by Q to R8 (ch), nor can he play K to Bsq on account of R to Bsq (ch). Or if P to K4. 19. Q to R7 (ch) K to B2. 20 R to Bsq (ch), K to Ksq. 21. Q to Kt6 (ch), K to Q2. 22. Q to Q8 (ch), K to Ksq. 23. R mates. Black actually played

18.	18. R to B6

19. P to Kt6, and Black resigned.

The Professor, although admiring the move of 18. Kt to Kt5, did not appear convinced on the whole, and promised to write an elaborate treatise on the comparative merits of problems and actual end-games.

Game played in the Handicap Tournament, played last month at Simpson's Divan.

WHITE. J. Gensberg.	BLACK. J. H. Zukertort.
1. P to K4	1. P to K4
2. QKt to B3	2. KKt to B3
3. Kt to B3	3. Kt to B3
4. P to QR3	4. P to Q4
5. B to Kt5	5. P to Q5
6. Kt to Kt2	6. B to Q2

If Kt × P, then probably 7. P to Q3, Kt to Q3; 8. B × Kt (ch), P × B; 9. Kt × KP.

7. P to Q3	7. B to Q3
8. Kt to Kt3	8. Kt to K2
9. B to QB4	9. P to KR3
10. Castles	10. P to KKt4

White threatened to break up Black's position by Kt × KP.

11. P to B3 !	11. P × P
12. P to Q4	12. Kt to Kt3
13. KtP × P	13. Castles
14. Kt to B5 !	14. Kt × P

If K to K2. 15. B × KtP, P × B. 16. Kt × P (ch), followed by Kt × P, with a winning advantage. Of course 14. B × Kt. 15. P × B followed by 16. P × P.

15. Kt × P (ch)	15. K to Kt2
16. P × P	16. B to K2
17. Kt × BP	17. Kt × QBP
18. Q to B2	18. R × Kt
19. B × R	19. K × B
20. Q × Kt	20. P to Kt5
21. R to Qsq	21. P × Kt
22. P to K6 (ch)	22. K × P
23. Q to Kt3 (ch)	23. K to B3
24. B to Kt2 (ch)	24. K to Kt4
25. Q to K3 (ch)	25. Kt to B5
26. R to Q5 (ch)	Resigns

The following instructive ending occurred in a game played in the Divan Tournament between Messrs. Zukertort and Muller: the former player in this position moved his K to Kt6, R to R7, and the

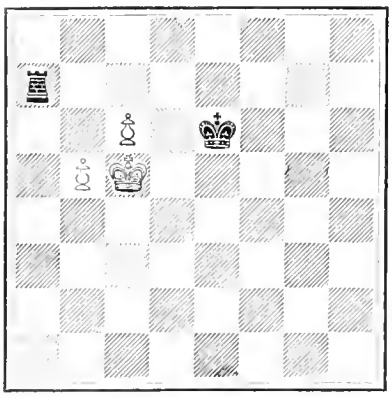
game resulted in a draw. Mr. Blackburne subsequently pointed out that White could have won by playing

P to Kt6,	for if	R to R4(ch)
K to Kt4,	then,	K to R8
P to Kt 7		R to Kt8(ch)
K to B5		R to B8(ch)

K to Q1, and White wins

MULLER.

BLACK.



WHITE.

ZUKERTORT.

THE FACE OF THE SKY FOR MAY.

By F.R.A.S.

SPOTS on the sun are both small and very infrequent, but his disc may be watched on clear days. The night sky is depicted on map v. of "The Stars in their Seasons." Mercury is a morning star at the beginning of May, coming into superior conjunction with the sun on the 10th. Then of course he travels to the east of the sun and becomes an evening star. At the end of the month he may be caught with the naked eye after sunset, over the N.W. by W. part of the horizon. Venus is a morning star, but her appearance is singularly insignificant when compared with that which she presented last November, when so many fatuous people hailed her as "the star of Bethlehem." Mars is still a striking object in the night sky, but his angular diameter is steadily and sensibly decreasing. It will be noted, too, by the sharpsighted observer with the telescope that he is no longer quite round. He will be found between θ and γ Virginis ("The Stars in their Seasons," map v.). On the night of the 5th he and Uranus will be so close together as to be in the same low-power field of a telescope. Jupiter is visible near to midnight, in fact sooner, but is so very low down that to be seen in the least degree favourably he should be looked at when close to the meridian. Jupiter is travelling towards β^1 Scorpii ("The Stars in their Seasons," map vii.), and will, in fact, be only 2′ north of that star during the early morning of the 21st. The phenomena of his satellites fairly observable at convenient hours during May are as follow. On the 1st the ingress of the shadow of satellite i. will happen at 11h. 43m. P.M., and that of the satellite itself twelve minutes after midnight. On the 2nd satellite i. will reappear from occultation at 11h. 42m. P.M. On the 5th satellite ii. will disappear in eclipse at 11h. 43m. 33s. P.M. On the 6th satellite iii. will suffer eclipse at 11h. 26m. 14s. P.M. On the 7th satellite ii. will pass off Jupiter's face at 9h. 58m. P.M. On the 9th satellite i. will disappear in eclipse at 10h. 59m. 13s. P.M. On the 10th the shadow of satellite i. will leave the planet's disc at 10h. 17m. P.M., followed by the satellite casting it at 10h. 33m. P.M. On the 14th satellite ii. will begin its transit across Jupiter at 9h. 46m. P.M.; its shadow will pass off at 11h. 53m, as will the satellite itself 12 minutes after midnight. On the 16th satellite i. will be eclipsed at 12h. 53m. 8s. P.M. On the 17th the shadow of satellite i. will begin its transit at 9h. 59m. P.M., as will the satellite itself at 10h. 6m. The shadow will leave Jupiter's opposite limb at 12h. 12m. P.M., and the satellite at 12h. 17m. On the 18th satellite i. will reappear from occultation at 9h. 36m. P.M. On the 21st the shadow of satellite ii. will enter on to Jupiter's limb at 11h. 58m., followed 2 minutes later by the satellite casting it. On the 24th the shadow of satellite iii. will begin its transit at 9h. 1m. P.M., the satellite itself leaving the opposite limb at 10h. 29m. P.M., and the shadow at 10h. 56m. Then, at 11h. 50m., the transit of satellite i. will begin, followed by that of its shadow at 11h. 53m. P.M. On the 25th satellite i. will be occulted at 9h. 8m. P.M., reappearing from eclipse at 11h. 23m. 37s. On the 30th, satellite ii. will reappear from eclipse at 11h. 12m. 11s. P.M. Finally, on the 31st satellite iii. will begin its transit at 12h. 12m., and its shadow follow it at 12h. 59m. P.M. Saturn is rapidly approaching the west, and must be looked for the moment it is sufficiently dark to be seen at all. He is in Cancer, to the west of the Præsepe ("The Stars in their Seasons," map iii.). Uranus should be looked for not much later than 10h. 30m. P.M. to be seen to the greatest advantage. He is in Virgo ("The Stars in their Seasons," map v.). We have spoken above of his conjunction with Mars on the night of the 5th. Neptune is absolutely invisible. The moon enters her last quarter at 11h. 47·1m. P.M. on May 2, and is new at 1h. 23·5m. A.M. on the 11th. She enters her first quarter at 11h. 5·1m. P.M. on the 18th, and is full at 1h. 40·1m. in the afternoon of the 25th. Four occultations of fixed stars by the moon will happen at fairly convenient hours during May. The first occurs on the 16th, when the 6th magnitude star d^1 Cancri will disappear at the moon's dark limb at 11h. 5m. P.M. at an angle of 74° from her vertex. It will reappear at her bright limb at 11h. 45m. P.M. at an angle from her vertex of 337°. On the 20th b Virginis, also a star of the 6th magnitude, will disappear at the dark limb at 12h. 57m. P.M. at an angle of 139° from the moon's vertex. It will not reappear until 1h. 41m. the next morning at the bright limb at a vertical angle of 251°. On the 24th η Libræ, a 6th magnitude star, will disappear at the dark limb of the moon at 10h. 52m. P.M. at an angle of 128° from her vertex, reappearing at her bright limb at 11h. 23m. P.M. at an angle from her vertex of 184°. Lastly, before the moon rises on the 27th, she will have occulted 31 Sagittarii, also a 6th magnitude star, with her bright limb. The star will reappear at her dark limb at 11h. 23m. P.M. at a vertical angle of 240°. When our notes begin the moon is in Sagittarius, but passes into Capricornus at 10 o'clock to-night ("The Seasons Pictured," plate xxi.). She takes precisely forty-eight hours to cross Capricornus, and at 10 P.M. on the 3rd emerges in Aquarius. She is travelling through Aquarius until 1h. A.M. on the 6th, when she enters Pisces ("The Seasons Pictured," plate xxii.). As she traverses Pisces, at 9 P.M. on the 6th she enters Cetus. It is not until 6h. 30m. A.M. on the 8th that she re-enters Pisces. At 5h. 30m. A.M. on the 9th she for the second time plunges into an outlier of Cetus, and when she finally quits this at 9h. P.M. on the 9th it is to come out in Aries. She remains in Aries until 1h. A.M. on the 11th, when she passes into Taurus ("The Seasons Pictured," plate xxiii.). As she journeys over Taurus, she arrives at 1h. A.M. on the 14th at the western edge of the northern prolongation of Orion. This she has crossed by noon, and come out in Gemini ("The Seasons Pictured," plate xxiv.). It takes her until 10h. A.M. on the 16th to cross Gemini, and at that hour she enters Cancer. She leaves Cancer for Leo at 1h. A.M. on the 18th. It is not until 4h. P.M. on the 20th that she passes from Leo to Virgo ("The Seasons Pictured," plate xxv.), and it is 4h. P.M. on the 23rd before she has completed her passage through the last-named great constellation and entered Libra ("The Seasons Pictured," plate xxvi.). Traversing Libra, she arrives at 7h. A.M. on the 25th on the confines of the narrow northern spike of Scorpio, having crossed which she, at 2h 30m., emerges in Ophiuchus. Here she remains until 2h. A.M. on the 27th, when she enters Sagittarius. By 7h. A.M. on the 29th she has completed her passage over Sagittarius and entered Capricornus ("The Seasons Pictured," plate xxi.). Here she continues until 5h. A.M. on the 31st, when she crosses into Aquarius. She is still travelling through Aquarius at midnight on the 31st.

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SHAKESPEARE SELF-DRAWN.

By "BENVOLIO."

"LOVE'S LABOUR'S LOST."

IN regard to the special inquiry on which we are now engaged, "Love's Labour's Lost," which in its original form was probably the first of Shakespeare's comedies, is one of the most interesting of all his plays. Regarded as a dramatic composition it is full of faults. It has no plot. It can hardly indeed be called a play, being rather a series of conversations. We catch only a few notes here and there of the wit and humour and play of fancy of the later comedies. Often, indeed, we find instead of wit a somewhat ill-mannered raillery, instead of humour mere verbal quips, and though play of fancy is by no means wanting in this play (any more than in the still earlier "Titus Andronicus"), the poetical passages in which it finds expression are overloaded with imagery unsuited (as Shakespeare perceived later) for dramatic expression. Again and again we find the poet who was to develop in a few years into the greatest dramatist the world has known forgetting apparently that he is writing a play, and penning passages which might have appeared among his sonnets, to be admired (in their proper place) for their "sugred sweetness" and condensed fulness of meaning. Indeed, there are passages in "Love's Labour's Lost" which seem to me to have been as clearly borrowed from Shakespeare's collection of poems and sonnets as Longaville's sonnet "Did not the heavenly rhetoric of thine eye?" Berowne's musical little poem "If love make me forsworn, how shall I swear to love?" and Dumain's "On a day—alack the day! Love whose month is ever May." The resemblance between the style of the "sugred sonnets" and the language of some of the characters in "Love's Labour's Lost" is so great that to any but the most constant students of Shakespeare it would be difficult to say (unless memory settled the question) that a sonnet selected for the test was not in reality part of the play, or that a part of the play similarly selected was not a sonnet.

As an example consider the sonnet :—

> Study me how to please the eye indeed,
> By fixing it upon a fairer eye;
> Who, dazzling so, that eye shall be his heed,
> And give him light that it was blinded by.
> Study is like the heaven's glorious sun,
> That will not be deep-searched by saucy looks:
> Small have continual plodders ever won,
> Save base authority from others' books.
> These earthly godfathers of heaven's lights,
> That give a name to every fixèd star,
> Have no more profit of their shining nights
> Than those that walk, and wot not what they are.
> Too much to know is to know nought but fame;
> And every godfather can give a name.

Shakespeare, of course, would be careful, when embodying poems in the speeches of his *dramatis personæ*, to make such changes as would give them a more natural air. To a writer of his versatility and ease of diction this would be a simple matter. We must not, then, expect to find many complete poems in "Love's Labour's Lost," though, as the earliest of Shakespeare's comedies, it would be in that play probably more than in any other that Shakespeare would have allowed himself this use of his poems. Indeed, in its actual form, "Love's Labour's Lost" is probably so changed from the form in which it originally appeared that we may wonder rather to find any traces at all of the piecing-in of outside poems, than that only a few traces here and there should remain. It is evident, however, that Shakespeare, in modifying and enlarging the play, paid more attention to the re-writing of passages which seemed to him defective, and to the addition of matter which seemed wanted to make the play complete, than to any such minor point as the removal of the signs of 'prentice work in this his earliest comedy. Here and there we note cases where changes of the former kind were somewhat carelessly made, so that signs of "joining" remain. For instance, near the beginning of Berowne's rather lengthy "salve for perjury," we find the lines :—

> For when would you, my lord, or you, or you,
> Have found the ground of study's excellence
> Without the beauty of a woman's face?

While, a little later, the same thought is expressed more fully in the lines :—

> For when would you, my liege, or you, or you,
> In leaden contemplation have found out
> Such fiery numbers as the prompting eyes
> Of beauty's tutors have enriched you with?

Evidently Shakespeare had intended to replace the former passage by the latter, but left several lines unobliterated, or so imperfectly obliterated that his purpose was not recognised.*

* The printers of the folio would seem to have been perplexed by the corrections—not made in MS. (for the MS. of "Love's Labour's Lost" was probably destroyed in the *Globe* fire), but probably written as alterations and interlineations in such printed copy as Shakespeare had used for the theatre text. Thus we find the following :—

> Learning is but an adiunct to our selfe,
> And where we are, our Learning likewise is:
> Then when our selues we see in Ladies' eyes,
> With our selues.
> Doe we not likewise see our learning there?

Here the words "with our selues" belong manifestly to the original version, but had remained unobliterated. The printers seem to have found much difficulty in deciphering their copy, whatever it may have been. Thus in the folio the following passage occurs, which would be quite unintelligible were not the true version otherwise known :—

> "*Cura. Laus deo, bene intelligo.*
> *Peda. Bome boon for boon prescian*, a little scratcht, 'twill serue."

Evidently the reviser and compositor could make nothing here of the copy. *Bome* in the first line seemed clearly wrong; so *bene* was substituted, which would have made nonsense of what follows, even had it been correctly read. But in the next line they found (probably) corrections of the originally wrongly printed words for "*Bome* for *bene*," and these (the correct words) were written somewhat indistinctly above the wrongly printed words imperfectly scored out. In some such way they found five words which they evidently regarded as all belonging to some strange tongue, and so produced the "jewel, five words long,"—*Bome boon for boon prescian*. What Shakespeare wrote was :—

> *Cura.* [Sir Nathaniel] *Laus deo, bene intelligo.*
> *Peda.* [Holofernes] *Bene*, for *bene*, Priscian a little scratcht 'twill serve.

[Possibly Mr. Ignatius Donnelly may find some specially Baconian significance in "Bome boon for boon prescian." It being nonsense as they stand, the words would suit the Baconian theory perfectly.]

But while the signs of revision are thus evident in "Love's Labour's Lost," it is Shakespeare's self that Shakespeare thus revised: while the signs of inexperience are thus clear, we have in this play inexperience striving by self-study to grow into experience, not borrowing from the experience of others. "Titus Andronicus" shows us Shakespeare striving to write a tragedy after the style approved in his day, and erring more through the modesty which led him to accept the ideas of others than through the daring which led him, as yet a beginner, to adopt the strongly-marked style of older writers. In the earlier-written among the historic plays we see Shakespeare directly copying the manner of Marlowe, whose "mighty line" doubtless seemed to him at that stage of his career not easily to be matched, nor to be possibly surpassed. But, so far as is known, Shakespeare was working alone and without the guidance of others in his first comedy.

It is true Shakespeare introduces into this conversational comedy several of the characters of the Italian drama which he was at this very time studying under Florio. But although it has been said by Gervinus that the tone of the Italian school prevails in "Love's Labour's Lost" more than in any other of Shakespeare's plays, this is only true in a very limited sense. Holofernes may correspond in a sense with the pedant familiar in contemporary Italian drama, but he is as thoroughly English as Fielding's Adams; Sir Nathaniel, the Curate, may be paralleled by similar characters in Italian plays, but George Eliot's Amos Barton is not more obviously drawn from the life than Sir Nathaniel from a Warwickshire curate whom Shakespeare had known in his youthful days. As for Armado—the Braggart of the folio—Shakespeare, short as had been his stay in London when this play was written, had evidently made the acquaintance of Euphuisto such as London knew in those days, Piercie Shaftons such as then infested Elizabeth's court; and we need go no more to the Italian drama for the original of Armado than for the original of "Rare Ben's" Bobadil.

Still more obviously drawn from Shakespeare's own, and at the time still recent, experience are the characters Dull and Costard (in the folio simply Constable and Clown), Jaquenetta and Moth. Costard is own brother, by the way, to the Clown in "Titus Andronicus," a character which of itself would suffice to disprove the theory that Shakespeare was not (as Meres described him) the author of that crude and repulsive, yet (in many passages) powerful, tragedy. Compare their talk, and the resemblance will be as obvious (while the individuality of each is as distinct) as in the case of Launce and Launcelot. "Didst not thou come from heaven?" Titus asks the Clown. "From heaven! Alas, sir, I never came there!" says the poor fellow (presently to be hanged). "God forbid I should be so bold as to press to heaven in my young days." Costard is not readier to be unduly pressing heavenwards: "Did you hear the proclamation?" asks Navarre; "I do confess much of the hearing it, but little of the marking of it." "Sir," says the king, "I will pronounce your sentence: you shall fast a week with bran and water." "I had rather pray a month," says the Clown, whose tendencies are nevertheless by no means towards prayer, "I had rather pray a month with mutton and porridge."

But it is worthy of notice how little of that power which later he possessed in such marked degree—the power of truthful and consistent drawing—Shakespeare possessed, or at any rate showed, when delineating Costard. For in places Costard is as dull a rogue as Dull the Constable—a heavier Dogberry—while elsewhere he is as ready and apt in response as Touchstone. "They have lived long on the alms-basket of words," he says of the pedant and the curate; yet the man who could thus in ten pregnant words picture the folly of Holofernes and Nathaniel, and could answer Armado's threat that he should be heavily punished with neat sarcasm—"I am more bound to you than your fellows,* for they are but lightly rewarded"—blunders in the use of words as foolishly as Dogberry or Elbow.

The Italian touches in this play are, however, worth noticing, as showing that when it was written—probably about 1588—Shakespeare had already been for some time studying under Florio. He would not otherwise have pictured so thoroughly English a dominie as Holofernes speaking of Venice as Florio might have done (who, despite the strange fancy of Warburton, was no more presented in the character of Holofernes than in that of Berowne)—Venegia, Venegia, chi non te vede, ei non te pregia.†

Though the four gentlemen whose labours of love are lost have French names given them, they were probably drawn from Warwickshire folk well known to Shakespeare, Biron (Berowne of the folios) was our familiar British Brown, Longueville simple Langton, and Dumain plain Hand (all three are local names). The king, of course, would not be so readily identified by Shakespeare's contemporaries at Stratford; he may have been either a local king or a local magnate. It is noteworthy that, though he is a gentleman in act and manner, he is somewhat slow of apprehension. Of the four lovers he is the dullest and unreadiest. In one place he shows himself scarce able to count up to five. (The grace with which, after correcting the king's counting, Berowne passes from the mistake is worth noticing.)

As for the ladies, we have no evidence except that derived from their manner. The princess may pass for a Frenchwoman or Italian—she is not drawn too definitely—but Rosaline, Maria, and Katharine are as thoroughly English as Jaquenetta or Audrey.

One is tempted to ask whether the black-eyed Rosaline may not tell us something of Shakespeare's weakness for dark women. We know from the later sonnets that after he had passed the days of early youth he was moved, despite his truer self, to love a dark lady who was not even beautiful, and whom by his own admission he could not love without being more seriously forsworn than Biron or his fellows. *On revient toujours à ses premières amours.* May we not imagine that in Biron's weakness, Biron being manifestly the character of all those in the play with whom Shakespeare was most in sympathy, he sketched in some degree his own? (Have we any knowledge, by the way, of Anne Hathaway's complexion?) ‡

> I forsooth in love! I that have been love's whip;
> What! I love! I sue! I seek a wife!

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* Probably a misprint for "followers."

† On the folio these words are strongly presented insomuch that one wonders what Shakespeare can possibly have written to be so mistaken. They run—"Vemchie, vencha, que non te vnde, que non se perreche." Possibly the MS. had the words—"Venechie, Venechie, que non te vede, ei non te perrechie," corresponding with a method of spelling which was even at that time passing out of vogue.

‡ It is worthy of notice with what zest Shakespeare pictures the love of Silvius for Phebe in "As You Like It." Altogether a minor character, and having but few words to utter, Silvius yet speaks his love more earnestly, if less volubly, than either Rosalind or Celia. Now it is noteworthy that Rosalind, in appraising Phebe, speaks much as Shakespeare would have presented such as Rosalind speaking of the dark lady of the sonnets:—

> I see no more in you, than in the ordinary
> Of nature's sale-work. Od's my little life!
> I think she means to tangle my eyes too.
> No faith proud mistress, hope not after it:
> 'Tis not your inky brows and black silk hair,
> Your bugle eyeballs nor your cheek of cream,
> That can entame my spirits to your worship.

Nay to be perjured, which is worst of all:
And, among three, to love the worst of all;
A whitely wanton with a velvet brow [*velvet* for *black*]
With two pitch balls stuck in her face for eyes.
And I to sigh for her! to watch for her!
To pray for her! Go to; it is a plague
That Cupid will impose for my neglect
Of his almighty dreadful little might.

Compare with this the self-drawn Shakespeare of the later sonnets, and it will at least be seen that, in attributing something of Biron's weakness for dark-browed, black-eyed, pale-faced women to the poet himself, we do not wrong him. Even the strange charm which Biron seems half to admit that he finds in the suggestion that Rosaline is amorous ("Ay, and by heaven," &c.) Shakespeare found in the dark lady of the sonnets:—

When my love swears that she is made of truth,
I do believe her though I know she lies.

. . . . .

O, love's best habit is in seeming trust, &c.

For the rest, the whole story of "Love's Labour's Lost" speaks of Shakespeare's loving recollection of the fair scenes and forest life of Stratford and Charlecote! From the first scene ("a Park with a Palace in it," but a palace into which none of the characters enter), through all the others (always "another part of the Park"), to the last songs of Spring and Winter, the whole play is full of English country ways and sylvan life.

FORCE AND ENERGY.

IN his otherwise capital work, "The Story of Creation"—the main portion of which appeared, by the way, in these pages—my friend, Mr. Clodd, continues his use of the word "force" to represent attraction, and "energy" to represent repulsion. But he gives reasons for the adoption of this incorrect usage which serve to show how it had its origin in the entire misapprehension by others of the actual use of the terms "force" and "energy" in books properly described as scientific:—

"In attempting," he says, "to give a clear idea of the mechanism of the universe, I have felt the difficulty expressed years ago by such authorities as Sir W. R. Grove and Professor Tyndall, arising from the lack of precision in standard books on physics in the use of the terms 'force' and 'energy.' When talking over this matter with my friend Grant Allen, I was delighted to find that he had published (although privately) a pamphlet on the subject, in which rigid and definite meanings are given to 'force' and 'energy' as the twofold and opposite forms of power manifest through matter; and in that sense, as affording the reader a clearer conception of cosmic dynamics, those terms are used throughout this book."

In the body of the book (p. 13) Mr. Clodd gives these "rigid and definite meanings" (their rigidity and definiteness are, indeed, unmistakable), which will rather raise the eyebrows of the scientific students of dynamics, especially when considered in connection with his purpose of clearing his readers' conceptions. They run as follows:—

(*a*) *Force* is that which produces or quickens motions binding together two or more particles of ponderable matter, and which retards or resists motions tending to separate such particles.

(*b*) *Energy* is that which produces or quickens motions separating and which resists or retards motions binding together two or more particles of matter, or of the ethereal medium.

By the oddest confusion between energy *as thus defined*—which, of course, is no other than our old friend, repulsive force—Mr. Clodd goes on to say of Mr. Grant Allen's "energy" what is only true of energy as correctly defined:—"A stone lying on a roof, a clock wound up but not going, have," he says, "potential energy" [that is, according to definition (*b*) they have potentially "that which produces or quickens motions separating, and which resists or retards motions binding together two or more particles of matter"], and this energy "becomes kinetic" (or is actually displayed in motion) when the stone falls or the clock goes. Yet I suppose it will be admitted of the stone (the clock may go by the out-pressing of a spring, a case of repulsion, or by the down-drawing of a weight, a case of attraction) that the potentiality possessed by it while at rest is a tendency to go towards the earth, a motion not separating but drawing together particles of ponderable matter. The distance it may have to travel when once freed to yield to the attractive influence (technically called the attractive force) measures the stone's power of getting into motion (technically called its "potential energy"). The motion it thus acquires, when considered not simply as motion, but in connection with the mass moved, is technically called *kinetic energy*. When the stone is brought to rest this kinetic energy remains in the movements of the stone's particles and of the particles of air around it—either in actual displacements, or in the vibratory motions whose effects are rendered sensible as heat. The former neither falls under definition *a* nor under definition *b*, because the particles moved draw towards some and from other particles. Nor can the vibrating particles be said to display attractive or repulsive (aggregating or separating) tendencies, their motions being essentially alternating. Mr. Clodd's—or rather, I suppose, Mr. Allen's—barrel of gunpowder has, on the other hand, unquestionably separating or expansive or repulsive potencies, which become kinetic when the powder is fired. Yet even here definition *b* does not apply to these tendencies in the rigid or definitive manner imagined by Mr. Allen and conceded by Mr. Clodd. The bottom of the barrel is pressed towards the ground by the action of what is technically called the explosive force of the powder; a fragment of the barrel, after flying a certain distance, strikes some other body: in each case the action displayed—so far as the wood, the ground, and the struck body are concerned—is of the kind producing motions drawing particles of ponderable matter together, not separating them. If this reasoning is objected to for the reason that the particles of gunpowder alone are to be understood as having potential energy according to definition *b*, the fault lies with the definition, which either says too much or too little—too much if we are to be thus limited, too little when the case of the stone is considered (for where are the particles potentially tending to separate in the stone's case?)

The fact is, Mr. Allen has obviously misunderstood altogether the trouble in regard to the inexact expressions employed occasionally by Sir R. Grove and Professor Tyndall (one may add Professor Huxley and Mr. Herbert Spencer), a mistake arising rather from the assurance that they could not be misunderstood, than from want of familiarity with the accepted limitations of the words "force" and "energy" as technically used from the time of Newton until now—in treatises on dynamics.

Sir W. R. Grove was taken to task, in somewhat pedantic sort, for speaking of electricity, heat, light, and the like, as physical "forces" in the title of his well-known work and elsewhere, instead of always (as in many parts of that treatise) speaking of them as "affections of matter." He in effect replied that the word "forces" as thus used could not well be misunderstood. His chief object had been to show that those "affections of matter" are "modes of motion," and every one would know that "modes of motion" cannot be described as "forces." Considering specifically (p. 18) the objection that "the term force" should be used "not as expressing the effect" (that is, motion or some affection of matter involving or depending on motion) "but as that which produces the effect," he says, "this is true,

and in this its ordinary sense I shall use it in these pages"—because "the term has thus a potential meaning, *to depart from which would render language unintelligible*"; though, as he quite correctly points out (the remark in no sense affecting his opinion as to the impropriety of any attempt to alter the technical use of the word "force"), "we must guard against supposing that we know essentially more of the phenomena by saying they are produced by something" (*force*), "which something is only a word derived from the constancy and similarity of the phenomena" (*motions* of various kinds) we seek to explain by it.

Assuredly Sir W. R. Grove would be far from welcoming the proposed limitation of the word "force" to one-half of its accepted significance, and the substitution of the word "energy" for the other half, with accompanying maltreatment of "attraction" and "repulsion" scarcely less painfully tending to (and suggestive of) bewilderment.

Professor Tyndall was very sharply, and as I think most unfairly, taken to task for using the word "force" (both in the singular and plural) as Sir W. R. Grove had done. Yet Professor Tait was undoubtedly right in saying that "the sense in which Newton uses the word 'force' is the sense in which we should continually use it" (if we are professedly using it technically) "if we desire to avoid intellectual confusion." And certainly Tyndall, who repeatedly distinguishes between attractive and repulsive "forces," and clearly recognises the correct meaning of "energy" as simply the capacity (potential or active) for doing work, would be sorely troubled at the thought that any looseness of expression on his part, where his real meaning could not be misunderstood, should have suggested the astounding idea of merging the distinctive word "attraction" into the general word "force," and the equally distinctive word "repulsion" into the word "energy," which (as constantly used in scientific treatises on dynamical physics) is perfectly distinct from all three.

Professor Huxley, whom I hold to be the most perfect living model of the man of science (because of all men known to me he is the readiest alike to maintain what he considers should be maintained and to concede what he considers should be conceded), used the word "forces" where, as he afterwards noted, the more general term "powers" would have been better. Is he likely, therefore, to rejoice to see the good old word which has now for two centuries done the same office in ten thousand scientific treatises invited to do half duty, and another word of entirely distinct character invited to abandon its own useful office and do the other half of that duty? Far from it. With characteristic manliness he goes out of his way (as weaker men would hold, but such a man as he can spare the extra travel when it seems necessary) to say that he would rather now write "powers" where he formerly wrote "forces." How Mr. Clodd has come to regard this frank admission by Professor Huxley that the word "force" should be limited to its proper use, into support of the entire misuse of that word (and others) I altogether fail to understand. What men like Sir Wm. Thomson (whom Sir R. Grove—rather significantly—calls Thompson), Professors Cayly, Adams, Sylvester, and their like, would say to the suggestion that the words "Force," "Attraction," "Repulsion," and "Energy" should be shuffled about as Mr. Allen has suggested I can guess, though I would rather not say. The mildest punishment they would inflict—though I fancy it would not be found very easy penance—would be that Mr. Allen should suggest some way of expressing the ideas now represented by "Energy," "potential energy," and "kinetic energy"; for assuredly his new definitions, whether regarded as rigid and definitive or as loose and ill-fitting, would leave these conceptions entirely unrepresented. The more severe would suggest that Mr. Allen should revise according to his novel ideas the whole body of scientific literature relating to matters dynamical. The nature of the task may be inferred from the first two steps which would have to be taken. How would Mr. Allen re-word the two first laws of Newton, remembering that, though originally written in Latin, these laws were repeatedly referred to by Newton as worded in English, thus?—

I. *Every body perseveres in its state of rest or of uniform motion in a right line, unless it is compelled to change that state by* FORCES *impressed on it.*

II. *The alteration of motion is ever proportional to the motive* FORCE *impressed, and is made in the direction of the right line in which that* FORCE *is impressed.*

May I be permitted to present a parable for the benefit of—whomsoever it may concern?

For centuries the words "trade" and "wealth" ("potential" and "material") had been used in all treatises on Political Economy in the sense in which they are still understood. But it chanced that several writers—among them an able theologian, a learned lawyer, and an experienced archæologist—in writing on their several subjects used the word "trade" where the more general word "commerce" would have been better, and seemed (but only seemed) to confound the word "manufactures" with the expression "material wealth." A pedant or two corrected this, though the writers criticised pointed out that no one could misunderstand their meaning. Hearing of this, an entomologist of great acumen as a naturalist and singularly graceful as a scientific writer, but whose studies gave him no actual occasion to write about trade or commerce or manufactures, or political economy generally—who, in fact, rather disliked these subjects—advocated an entire change in business language. Let us hereafter, said he, call all forms of importation *trade* and all forms of exportation *wealth*. . . . It was urged that the four good words——Trade, Import, Export, and Wealth—would all be put to entirely new uses, if the change were adopted; that the literature of political economy would have to be rewritten; and that new expressions would now have to be adopted to express what had heretofore been understood by Wealth, Material Wealth, and so forth. One might as well, said one, speaking as in a parable, propose that Dress should signify the Clothing of Men, and Costume the Clothing of Women. Whether the innovator (who had in the meantime taken to writing fairy tales) was convinced, this deponent sayeth not. But the new usage was not adopted—and it never will be.

Mr. Grant Allen would do well to test the idea expressed in his privately published pamphlet by preparing a small treatise on some dynamical subject involving all four of those conceptions—"Force," "Energy," "Attraction," and "Repulsion"—respecting which he has been moved to anxiety. Unless I mistake, he would find his rigid and definite meanings perplexingly elastic and confusing. A pamphlet on the motion of a shell moved by the repulsive action of exploding powder, and travelling in a resisting medium, first against the attractive action of gravity, and afterwards in response to that action, would afford excellent exercise, not only for the writer, but for the reader (if the new nomenclature were consistently adopted), especially if the shell were suffered to explode just before reaching the earth, and the movements of its parts (assumed equal and of given number) were carefully dealt with. Science is entitled to ask that those who suggest new uses for words which have been for centuries used (*by Her*, at any rate) in determinate ways, should in some such way show the convenience and value of the new nomenclature, and manifest

some sort of right (based on special knowledge) to propose changes in the language of science.

My protest has been urged in the interests of the class of writers for whom I myself have striven to cater, and for whom Mr. Grant Allen and Mr. Clodd have catered most successfully. The former in particular (I know my friend Mr. Clodd will not be angry with me for putting the matter thus) is, to my mind, simply unequalled by all our English writers on popular science for grace and elegance of style and versatility of treatment. (It grieves one to the heart to think that powers such as his should for want of the due appreciation of science in our day be increasingly wasted on those who appreciate only sensational fiction.) But it is because I feel deeply interested in the spread of sound information about scientific matters among the general public, that I protest earnestly against changes which, by separating the language of scientific literature from the language of exact science, would tend if accepted to make "confusion worse confounded"—by replacing mere difficulty of apprehension (such as all exact scientific studies involve) by sheer bewilderment. Carelessness in the use of scientific terms is doubtless unfortunate; but studied inaccuracy would be a disastrous remedy.

THE STAR STORY OF THE FLOOD.

(*Continued from page* 147.)

AMONG the constellations which have thus been deprived of their ancient character, none equalled in interest the great ship Argo. It is difficult for any one who studies a modern map of this constellation to imagine that it was ever like a ship. Nay, the resemblance cannot now be well traced even in the heavens, for a reason presently to be considered. Yet the configuration of an immense ship, with lofty, well-rounded poop, with masts and sails, and deck and keel, is singularly striking, when the original extent of the constellation (reduced by modern astronomers) and its original position (changed by that slow precessional reeling of the earth which has for its period 29,000 years) are taken into account.

As to the original extent of the great ship Argo, astronomers of two distinct ages have been at work cutting off parts of the ship piecemeal. Originally, as the heavens still tell us, the ship had a noble prow as well as that lofty stern of which I have spoken. But the astronomers of some 2,500 years ago, in altering the figure of a man standing at the prow into a Centaur, removed to make the horse part of the Centaur the stars which had originally formed the prow of the great ship. (I have no authority for this last statement except the prow-like form which the stars of the Centaur's body picture; but for the former there is the evidence of ancient astronomers that the constellation which later represented the centaur Cheiron—identified by some with Noah—originally represented a man, not a man-horse.) In the time of Eudoxus (about four centuries before Christ), whose ideas about the constellations the poet Aratus presented two centuries later, Argo represented the stern half of a ship, drawn backwards into harbour. I find that, as might be expected, this corresponds with the aspect and position which the constellation then had. When at its full height in the southern skies of Greece, or Egypt, or Persia, Argo's keel was aslant, the stern end being considerably higher than the fore part, so that as the diurnal motion carried Argo along stern first, the motion was like that of a ship drawn stern first up a slant shore. At present this idea is no longer suggested, the slant being now so great that nothing but hauling a ship stern first up a cliff would correspond with the celestial position and motion of Argo; and ships are not so commonly hauled up cliffs in that manner, that even the most imaginative mind would find such an idea absolutely forced upon it.

In the time of Eudoxus also, the poop of the ship had been to some degree interfered with as well as the prow, for some of the stars of the stern are wanted to complete the figure of the Greater Dog. But probably in Eudoxus's time there was not the least difficulty in regarding these stars as doing double duty. The fore-half of the ship had been bodily removed, but the outline of the stern was not probably impaired at all to make room for Canis Major. In our time, of course, this has happened. The outline remains still somewhat like that of an ancient poop, but it is not nearly such a fine poop as the old ship had. Not only the stars marking the dog's hind quarters have been removed, but as the outline of the poop is thus contracted, another group of stars formerly belonging to Argo can no longer be included within the outline. Out of the stars of this group Hevelius formed the constellation Noah's Dove, apparently judging that it was a rather ingenious device to represent the dove as flying from what was originally the rudder (or stern oar) of the ark. But the moderns have done worse even than this, clipping off one part of the keel of the ark to make, or help in making, a Chamelcon, and another part to help in making a Flying Fish. This was Lacaille's work. On the other side—that is, in the ship's upper works—he was equally absurd, setting in the ship's masts—or perhaps on the roof of the ark—an Air Pump, of all unlikely objects to occupy such a position. Another modern constellation, the Southern Cross, though really part of the original ship, was taken from it long before modern times, to form the hind feet of the Centaur. The modern astronomer, therefore, has not constructed the Cross out of the ark, in which there might have been found a world of suggestive meaning, but has abstracted it from what was already an abstraction, the hinder portion of the centaur Cheiron.

So soon as we picture the stars of this region as they were in the time of the Great Pyramid, and (practically) for three or four centuries before and afterwards, we find such a ship as the modern stellar skies no longer present—a constellation so striking that even the least observant must have recognised its ship-like form.

In the first place, Argo falls in the most remarkable part of the whole heavens. Covering the richest region of the stellar skies, it is bordered by a broad tract which is absolutely the darkest part of the star-sphere. Between the thinly strewn region which marks the sails and mast of the ship as at present pictured, and the long winding stream of stars marking the sea-serpent Hydra, over a tract extending from the head and shoulders of the Centaur to the constellation of the Little Dog—a range of nearly ninety degrees!—there is not a single star of the first, second, or third magnitude, while there are only three stars of the fourth, and very few of the fifth magnitude. The rich tract formerly occupied by the Great Ark, and now occupied by the Centaur, Cross, Southern Fly, Argo, the Dove, and the Greater Dog, though less in extent than this poverty-stricken region, contains six first-magnitude stars, twelve of the second magnitude, thirty-two of the third—that is, no fewer than fifty stars of the first three magnitudes alone, besides an amazing wealth of stars of the fourth, fifth, and sixth magnitudes, and widely spreading masses of the Milky Way. The region thus richly crowded with stars of all orders, and distinguished from the surrounding heavens not only by the poverty of the region just described but also by another but narrower poverty-stricken region on the other

side (the keel line of the ship), is about eighty degrees long and forty degrees broad.

Now, in the time of the Pyramid builders, this region was so situated that its length was parallel to the horizon when the region was at its highest above the southern horizon. Thus the great ship had its proper position as floating on a sort of heavenly sea, the horizon of which was the celestial equator, along which was the great Sea-serpent, floating lazily onwards—for the motion of the star sphere carried Hydra forwards, his head reared above the sea level, towards the west. It is to be noticed also that the elevation of the ship above the natural horizon of Babylon, Persia, Greece, or Egypt, was such as to give the ship the most natural appearance possible, for the keel would be actually on the horizon of the three first-named regions, and raised very little above the horizon in the latitude of Athens. From a picture which I have drawn showing the southern skies of Babylon at midnight in winter—about the time corresponding to the middle of December—I find that Argo must then have presented such an appearance that it would require no liveliness of imagination whatever to picture a grand celestial ship there—nay, rather that only the dullest imagination could fail to have this idea suggested to it most strongly. Certainly the scene then presented by the star-strewn skies above the southern horizon was more striking than any which the skies present now, in any latitude and at any hour.

Recognising this remarkably suggestive aspect of the heavens in the days of the pyramid builders, and remembering the importance attached to the ship Argo alike by ancient observers of the stars, and as belonging to ancient myths, I was led to inquire further respecting the constellations brought successively above the southern horizon as the year passed on.

In the first place, I observe that preceding the arrival of the great Ship as the ruling southern constellation at night, there came a long array of those watery constellations—Capricornus, Aquarius, Pisces, and Eridanus—which the ancient astronomers regarded as undoubtedly associated with flood and deluge on the earth. Till far later times, the belief prevailed that when all the planets are conjoined in Capricorn the world would be destroyed by flood; but the superstition had its origin in that remote time to which we are now extending our survey. An old idea of mine was thus recalled to me, that in the constellations of the watery kind (as the old astrological astronomers considered them), the ship Argo, and certain others, the story of the flood as related in Genesis is presented—men either finding in the heavens the record of what had happened on the earth, or picturing a series of events in the heavens which they later transformed into a terrestrial legend. But now I had the means of dealing with this idea much more satisfactorily than when I touched upon it formerly in a merely suggestive way. For, in the first place, I now had the exact aspect of the stellar heavens for every month and every hour of the night at the time to which the story must be referred, and in the latitudes whence the Egyptian and Babylonian astronomers observed the heavens; and in the second place, the reading of the Ninevitish cuneiform inscriptions on the one hand and the study of Egyptian Biblical lore on the other, had thrown enough light on the deluge narrative to show how it was in a general sense to be interpreted.

In what follows, I employ the story of Noah in Genesis chiefly as giving the best record we probably have of what at the time of the Captivity was the accepted account of the deluge as to times and seasons. Probably the cuneiform inscriptions, as read by Messrs. George Smith, Sayce, and others, present rather a popular form of the legend than the full record which the priests of Babylon possessed, and which they were ready to communicate to the more learned and devout among the Hebrew priests. At any rate, it is clear that precise details as to dates were given to the scribes and priests of Judah, and by them transferred to their sacred books, the narrative being only so far modified as to emphasise the story of the origin of the Hebrew race as the chosen people of God.

The story, alike in Egypt, in Babylon, and in Jerusalem, relates to the tenth of the first generations dealt with by legend or history. Noah is the tenth antediluvian patriarch; Hor is the tenth Egyptian god; Xisuthrus is the tenth Chaldean king. The idea associated with the deity, king, or patriarch—according to the race among whom the story appears—is that of rest. The singular prophecy by Lamech respecting Noah, thus finds a partial interpretation: "This same shall comfort us for our work and for the toil of our hands because of the ground which the Lord hath cursed." But the explanation becomes clearer when we recognise in Noah a solar hero, and in the account of the deluge a very ancient solar myth—as Goldziher, Steinthal, and other Hebrew scholars (rejecting Professor Max Müller's idea that the Hebrews had no mythology) have learned to recognise. Xisuthrus is the sun at setting; the journey of Xisuthrus is the journey of the sun at night below the horizon: but also, as in all solar myths, the sun is dealt with here as god of the year, not solely or even chiefly as god of the day. Thus, the hero of the deluge legend is the god of winter, which, like night, brings rest from agricultural labours.

As in all solar myths, however, we find in the legend of the deluge the record of a full year, and—as has long been considered remarkable by Bible commentators—precisely one year of 365 days. The life of Enoch, it is to be noticed, is given as 365 years, and it is noteworthy that a certain confusion may be recognised between Enoch and Noah, as between their Egyptian and Babylonian analogues. The seventh Egyptian god, like the tenth, is named Hor; and, again, Xisuthrus, the Babylonian Noah, is translated after the close of his achievements as a solar hero, as Enoch is translated after his solar life of 365 days. It is true that the year of 365 days was not in general use either in Egypt or Chaldæa; but the length of the year was known to the astronomers of the Pyramid time with much greater accuracy than even the period of 365 days would indicate—probably it was known within a few minutes of the true value. Just here it may be noticed that the Jewish Midrâsh compares the course of the sun to a ship coming from Akrâmania (wherever that may be) with 365 ropes, and to a ship coming from Alexandria which has 354 ropes (354 being the number of days in a lunar year). There is a Phrygian legend that the king or patriarch Annakos, *i.e.* Enoch, being more than 300 years old, predicted the flood, and prayed with many tears and lamentations for the people. The dates directly associated with the flood in the Babylonian account, presented (we may assume) in Genesis, belong to Mesopotamia, where great floods attain their greatest height in spring, at the season indicated as the time when Noah's flood was at its highest. Dr. Bell tells of a flood in Mesopotamia so high at this season, that as far as the eye could reach nothing could be seen from the highest tower of the Baghdad mosques but a great waste of waters, studded here and there with a few date groves, which appeared like little islands: "Thousands of square miles," he says, "were at that time under water." These floods commonly begin towards the end of October, and the waters continue to increase, though the rains are not continuous until spring. But, of course, the Babylonian record of the flood, though it may have been

suggested by a natural Mesopotamian flood of this kind, relates to a flood much more widespread and far more terrible in its effects. We have here intermixed, after the customary mythical fashion, the magnified and intensified events of an ordinary flood, the diurnal progress of the sun-god (and especially his journey in a ship beneath the horizon) and the annual journey of the sun as god of the year, during a time when all the heavenly powers combined their influence in the watery constellations.

So much premised, let us trace the annual progress of the constellations which, at the time of the Pyramid builders and their Babylonian fellow-workers in astronomy were below the horizon of the star sphere—marked by the equator—and let us see how far the constellations as pictured corresponded with the events recorded in the narrative. It is to be observed that the mere agreement of a few cases would count for little. The agreement of several, in precise order, as well as in the characteristics of the constellations, would be more significant. But if we shall find the whole circuit of the star-sphere corresponding with the Babylonian narrative as presented in Genesis, and even the dates and periods there mentioned adequately represented, then, as it seems to me (regarding the matter as merely one of probabilities), the evidence will be decisive.

I picture to myself observers stationed in the grand meridional gallery of the Pyramid of Cheops, or in some similar observing passage in the Temple of the Planets at Babylon, watching, night after night, throughout the year, the constellations occupying the southern skies below the celestial equator—which at the Egyptian observatory ranged sixty degrees above the southern horizon and some two degrees less above the Babylonian. Only it must be remembered that the constellations they would see on the midnight sky would be those whose influences would affect their solar god, not at the season of observation, but just half a year before or after, when the sun would be travelling through or past those constellations.

Beginning, then, with the seventeenth day of the second month, which all agree would correspond with the end of October, we find the part of the stellar heavens in conjunction with the sun to be the beginning of the watery constellation Capricornus, regarded by ancient astronomers as of all the signs the one which most directly threatened flood. Thence for the space of nearly five months' journey the sun was in conjunction with none but watery constellations. After the Seagoat came the Water-Bearer Aquarius, whose jar and the streams flowing from it are pictured very strikingly in the heavens, however imperfectly shown in the modern much-reduced constellation. Then follow Pisces, the Sea-Monster Cetus, and the streams of Eridanus. (In my opinion the water streams from the vessel borne aloft by Aquarius were regarded as extending over Capricornus on the one side, and on the other over the Fishes, the Sea Monster, and the great river Eridanus, the whole of this large region of the heavens being most curiously traversed by a network of interlacing star-streams.) For one hundred and fifty days the sun was in conjunction with these watery signs, viz, from the end of October till about the time of the spring equinox, when also the terrestrial skies in Babylon seemed to respond to these watery influences. Now it is noteworthy that, although this watery region extended over one hundred and fifty days' sun-journey, the special flood signs extended only over forty days of the solar path. From the beginning of Capricornus to the place where the main stream from the water-can of Aquarius crosses the sun's path—or from near Alpha of the Seagoat to near Phi of the Water-Carrier, there are just forty days of solar travel. This corresponds precisely with the record of the flood. The rain was on the earth forty days and forty nights—and after the end of an hundred and fifty days (including the forty) the waters decreased.

At this stage we find, in the stellar story of the flood, the Ark floating on the wide expanse of pictured sea. Above, along the equator, lies (or rather lay, at the time to which we are looking back) the full length of the great Sea-Serpent; below that water horizon extended a broad tract of starless sky; and below that again the starry splendour of the great ship herself.

Counting now to the tenth month on the first day of the month, "when the tops of the mountains began to be seen, we reach the place where Cor Hydræ, the Sea-serpent's Heart, stood on the equator, the horizon of the celestial sea. Then followed forty days more, at the end of which Noah opened the window of the ark which he had made, and sent forth a raven." Now just at the corresponding point we find the ancient constellation of the Raven, standing on the Sea-serpent, or just above the equator, as if finding no place on the land. If we were to trust the modern pictures of the Raven, this might seem of little moment. For with characteristic perversity, the modern map-makers have turned this constellation upside down, and the case becomes one of those referred to by Mr. Lang, when the liveliest imagination can trace no resemblance between a star group and the object pictured. But the old globes and charts set this right. The raven is in reality a very characteristic bird. His high-shouldered attitude when at rest, and a certain angularity of wing then shown, are features which strike the observer at once. Now the constellation Corvus, representing the chief of the *Corvidæ*, the Raven, is also striking. It is a small group, but well marked, and surrounded by comparatively vacant skies. So soon as we picture a Raven standing upright on the Sea-serpent's back, not as in modern pictures in the attitude of a fowl picking up seed, we recognise the outline of a raven in the star-group, as distinctly as we see a Dolphin in the group so called, a crown in Corona Borealis, and other objects in similar small but well-defined groups. Thus the Raven of the flood story is well pictured in the heavens, and occupies precisely the position corresponding to the dates in the Babylonian record, as preserved for us in Genesis.

Then follow three weeks, or twenty-one days, corresponding to the intervals at which the dove was sent forth. I might dwell on this reference to the week, the first of the kind in the Bible pages, as of itself sufficing to indicate the astronomical, and especially Babylonian origin of the story. But I pass on to consider the rest of the record. I cannot find three doves in the stellar picture, nor could they be reasonably looked for. It is curious, however, that there are three characteristic undulations of the tail of Hydra, *i.e.* stars which require to be connected by an undulating line to keep up the serpentine idea—ranging over precisely three weeks of the diurnal motion of the star-sphere. The crests of the undulations are marked (1) by the stars Gamma and Psi; (2) by the star Pi; and (3) by a set of five small stars bearing no Greek letter, but numbered by Flamsteed 54 to 59.

And now we have reached the prow end of the ark, and find standing there the human part of the Centaur, a fine manlike figure. This constellation has always been regarded as bearing sacrifice to the Altar, Ara. He was upright in the southern skies at the time we are dealing with, a circumstance which helps the imagination in picturing the figure of a man. His head was marked by a group of small stars; Theta and Iota marked his shoulders, Alpha and Beta his feet. A long straight row of stars, extending on the east to Kappa, marked the spear or rod, on which he bore an animal, later called a wolf, towards the altar. Few of the human constellations are so characteristically defined in the

heavens as the man part of the Centaur, with his spear and offering for sacrifice. Standing upright, some twenty-five degrees in height, and so that as seen from the ascending passage of the Great Pyramid, he just stood, when due south, within the portion of the heavens commanded by the grand gallery, this stellar figure must have presented strongly the idea of a man offering sacrifice—at least to a race accustomed to see their priests daily engaged in sacrificial observances.

But the Altar, where is that? The constellation of the Altar is there still, both in the heavens and in our maps. But since the fifteenth century the altar has always been represented upside down, insomuch that the Centaur is represented as carefully applying a wolf to the altar's inverted base, a proceeding which would have seemed unreasonable even to one of the drunken Lapithæ. However, there is luckily no sort of doubt that this arrangement of the altar is only a "modern improvement." The Farnese globe shows the Altar upright—that is, as upright as it could be since the precession of the equinoxes tipped it over. Manilius distinctly suggests its uprightness when he speaks of the Altar as

Ara, ferens thuris, stellis imitantibus, ignem.

For an inverted Altar could not have been seen as bearing anything. Turning to the heavens of 3400 or 3500 B.C., we find the Altar truly upright, and we see the smoke of the incense, imitated by stars in the rich streams of the Milky Way, which extend from the altar like ascending clouds and wreaths of smoke, over the Scorpion on one side and over Sagittarius on the other. The brightest galactic stream here is that over Sagittarius, where, indeed, the Milky Way has at once its most resplendent and its most variegated aspect. The incense smoke from the altar on the side towards Scorpio fades off into the dark background of the sky, but on the side towards Sagittarius there is a bright and continuous stream, gathering in places into rich clustering masses.

The sacrifice of Noah is accepted by Deity, the smoke bearing the essence of the fire-consumed flesh was of a sweet savour in His nostrils, to use the quaint expression of later Bible writers. "And God said," says the ancient record we are following, "This is the token of the covenant which I make between Me and you and every living creature that is with you for perpetual generations: I do set my bow in the cloud, and it shall be for a token of a covenant between Me and the earth." It may be regarded as a mere coincidence, though strange as coming after the coincidences already noted, but certain it is that in the cloud rising from the Altar, the bow of Sagittarius was recognised by the ancient worshippers of the sun and moon and stars. There is the figure of a man or god, standing on the other side of the Altar, facing the man who offers sacrifice (coming upright, like him, on the meridian of the time we are considering), and this figure holds out in the cloud from the Altar a celestial bow (twenty degrees in length), which might well have been regarded by the astronomical priests of those days as typifying the rainbow, and its promise as recorded in the ancient story of the flood.

And here in the stellar skies, as in the detailed record, the year has completed its full circle. Immediately beyond the figure of the being holding the bow, we come upon the constellation of the Sea-goat, where the story of the flood begins again in the heavens. On the seventeenth day of the second month the flood began, according to the record in Genesis, on the seven and twentieth day of the second month was the earth dry—a year of twelve lunar months had passed, 354 days (the 354 ropes of the old sun-ship story), and in addition eleven days, completing the solar year of 365 days. If we have not here a solar myth, pictured in the stellar heavens, and, as it were, reflected in the terrestrial skies, and the annual floods of Mesopotamia, then it would seem as though all belief in solar myths and nature myths must be rejected; for certainly in not one single case have the believers in such myths found such evidence as we have found here. I do not say that no such evidence might be collected for those other myths. I believe that by the help of astronomical research the evidence of those myths can be greatly strengthened. But certainly in the present case, the first I think which has ever been dealt with in this manner, the evidence seems very striking. If it is all to be explained away as due to mere chance coincidence, then must the coincidence be regarded as so remarkable, that even as such it is well worth studying.

GROWTH OF THE ALPS.*

THE Alps have been studied longer and more thoroughly than any others of the great mountain ranges of the earth. Their structure is, in fact, typical. Although it is now considered doubtful whether any of the exposed portions of the Alps can be regarded as of Archæan age, there is absolutely decisive evidence of the growth of the Alps from Silurian strata through all the higher primary formations, and thence upwards and onwards through the secondary and tertiary periods to the great glacial age which was, as it were, the threshold of the period through which Europe is now passing. The record we have to read is necessarily imperfect. The forces by which stratified rocks are subjected to plications and fractures have acted with amazing energy on the Alpine strata. The characteristic features of the lower strata have gradually disappeared among those of the crystalline masses forced through them. "The whole geological aspect of these mountains," says Professor A. Geikie, "is suggestive of former intense commotion." The record has also been in large part destroyed by denudation. "Twisted and crumpled," Professor Geikie proceeds, "the solid sheets of limestone may be seen as it were to writhe from the base to the summit of a mountain; yet they present everywhere their truncated ends to the air, and from these ends it is easy to see that a vast amount of material has been worn away. Apart altogether from what may have been the shape of the ground immediately after the upheaval of the chain, there is evidence on every side of gigantic denudation. The sub-aërial forces that have been at work upon the Alpine surface ever since it first appeared have dug out valleys, sometimes acting in original depressions, sometimes eroding hollows down the slopes. Moreover, they have planed down the flexures, excavated lake basins, scarped the mountain sides into cliff and *cirque*, notched and furrowed the ridges, splintered the crests into chasm and *aiguille*, until no part of the original surface now remains in sight."

But though the Alps thus "remain a monument of stupendous earth-throes, followed by prolonged and gigantic denudation," they yet attest with sufficient clearness the processes by which the material of their structure was originally formed. The volumes in which the record was written are all more or less incomplete, but none are absolutely missing—unless it be the first, if we can speak of the first volume of a series which in point of fact can scarcely be said to have had a beginning.

* Chiefly from an article on "The Everlasting Hills," in the *Fortnightly Review*.

The first leaves of the first extant volume are so blurred that their meaning is doubtful. Formerly it was held that a continuous belt of absolutely Archæan rocks can be recognised westwards of the central portion of the Alpine range. But now it is doubted whether the Alpine formations once regarded as Archæan are really so. Yet even holding them, as the only possible alternative compels us, to be but metamorphosed equivalents of what originally were lower Palæozoic strata, their record is scarcely less impressive.

A little higher—that is, a little later in the volume—we find unmistakable Silurian, Devonian, Carboniferous, and Permian rocks, unmistakable because of the fossil forms present in them. The oldest fossils actually recognised are Upper Silurian, and speak of a time which, even at the most moderate computation, must be set twenty millions of years back. No geologist, no palæontologist, no biologist of repute would admit any approach to so recent a date as that; but astronomical and physical considerations *appear* to suggest that we should to that degree shorten the immense periods of time which the geologist regards as demonstrated by the terrestrial record. Taking only that degree of remoteness, and noting that these Upper Silurian strata rest on unfossiliferous crystalline rocks which are certainly much older, our record goes far enough back to overwhelm us by the unimaginable time-intervals of which it bears testimony.

It is curious to read, in these older books of the earth bible, not only of organic remains speaking of the former existence of seas covering the innermost core of the Alpine range, but of abundant corals of Devonian age. For corals are the products of such slow processes of formation that they are eloquent in the evidence they give respecting time. In the carboniferous strata, which belong to a later portion of this earliest Alpine record, we find evidence of an abundant flora, no less than sixty forms of vegetation characteristic of that era having been recognised. How many thousands of years the sea stood there and coral reefs were builded up, how long the interval may have been during which for a while these seas retreated and forests grew on the low-lying lands above their level, we cannot tell. But we know that those periods must have been incomparably longer than those by which we measure the history of man.

Red sandstone tracts attest the progress of the Permian era and renewed presence of the sea. Higher (measuring stratigraphically), and therefore later, we find limestone strata crowded with evidence of marine life. Whole layers of these Triassic rocks are formed of the crinoid stems of fossil echinoderms, sea-urchins, brachiopods (including the familiar* but most ancient mollusc, the common terebratula), are found in large numbers. Corals are abundant, and fossil cephalopods, including multitudes of nautili, tell us not only of the forms of life present in that ancient Triassic sea, but also that the more ancient seas could never have departed wholly from the Alpine region, seeing that many of these Triassic fossils are survivals of forms of life belonging to the Palæozoic period. In passing it may be remarked that certain strata, somewhat metamorphosed but manifestly belonging to the Trias, were penetrated in piercing the Mont Cenis tunnel, and showed a thickness of more than thirteen thousand feet. On the Northern Apennines these strata include the celebrated statuary marbles of Carrara.

* Familiar in appearance, and so commonly found by the seashore, attached to submarine bodies, that probably every one who has ever walked beside the sea has handled dozens of their shells; yet science not only recognises their vast antiquity, but has given them very hard names, calling them "palæobranchiate acephalous bivalve brachiopod molluscs."

The great thickness of the Triassic limestone in the Eastern Alps appears to show that they must have formed in open seas, free from inroads of sandy or muddy sediment. It is believed by some that in the conglomeratic dolomites of the Eastern Alps we can recognise signs of the breakers of that ancient sea, grinding down the coral reefs and carrying the thin dolomites into the lagoons within.

Higher and later yet, in the Jurassic series, we find similar evidence. Reddish well bedded limestones, so crowded with *Terebratula diphya* as to be called the Diphya limestone, lighter limestones full of cephalopods, immense coral reefs—all these attest the long-lasting influence of this second stage of the great Mesozoic or secondary period in the formation of the Alpine range.

Then came the last stage of the secondary period, the Cretaceous. It is strange to picture a time when, where now the Alps rear their snow-covered peaks, there were wide seas, beneath whose surface such layers were forming as those out of which the chalk cliffs of Albion have been carved. Nay, we have evidence that in that selfsame region were once seas bounded by just such cliffs, for while we find layers of Cretaceous formation hundreds of feet thick in the Alps, we find also intercalations of coal-bearing fresh-water beds, showing how the seas from time to time retreated for periods long enough to permit of the aggregation of these coal-bearing strata. From some of the lake-beds of that age in the Alps large numbers of reptilian remains have been obtained, including dinosaurs, turtles, a crocodile, a lizard, and a pterodactyle; in all, no fewer than fourteen genera and eighteen species. But, of course, the greater portion of the matter belonging to the Cretaceous era in the Alps is of marine formation.

And now the record brings us to recent times—not more, perhaps, than a million of years ago, or some such trifling period as that.

Of the earlier tertiary era, the Eocene, the dawn of modern life-forms has left clear evidence in the Alpine rock-masses. A remarkable feature of the Eocene strata in the Alpine region is the presence of immense erratic boulders of far greater antiquity, apparently carried off by great glaciers from Archæan masses such as still exist in Southern Bohemia, and borne across sea on ice-floes to the Alpine shores. But if a wide sea existed during the Eocene age in the Alpine region, there were alternations during which land appeared, for in the Northern Tyrol a seam of coal thirty-two feet thick occurs as an Eocene deposit.

The Oligocene age, still nearer to our own time, is represented with wonderful fulness in the Swiss Alps. Massive mountains, such as the Rigi and Rossberg, are almost wholly formed from Oligocene strata, several thousand feet in thickness, out of which they have been carved. They attest very clearly the presence of the sea, but they have also preserved in singular perfection large numbers of the plants originally clothing the neighbouring Alpine shores, and even the insects which, in those far-off ages, flitted through the Alpine woodlands.

In the Miocene or latest portion of the tertiary age we have clearer and fuller evidence yet. "In the Oeningen beds," says Archibald Geikie, "so gently have the leaves, flowers, and fruits fallen, and so well have they been preserved, that we may actually trace the alternation of the seasons by the succession of the different conditions of the plants. Selecting 482 of those plants which admit of comparison, Heer remarks that 131 might be referred to a temperate, 266 to a sub-tropical, and 85 to a tropical zone." Between 800 and 900 species of insects have been obtained from Oeningen. Wood-beetles were especially numerous and large. "Nor did the larger animals escape preservation," to quote Geikie's rather odd expression, in the silt of

the Oeningen Lake. Tapirs, mastodons, rhinoceros, musk deer, apes, opossums, three-toed horses, were among the inhabitants of that Alpine region. Ancient ruminants long since extinct were numerous. The huge dinotherium floated on the lake, or held on to the banks by the huge tusks of his under-jaw. Frogs, toads, lizards, snakes, squirrels, hares, beavers, were abundant, as well as numbers of small carnivores to feed upon them; for if Nature "never makes mouths but she finds food," she assuredly attends to the converse arrangement with at least equal anxiety.

The last stage of all—that is, the last of all the grander stages of geologic time—belongs to the glacial era. As far as Lyons along the Rhone valley, extending through the transverse valleys of the Jura as far as Ornans (near Besançon), along the Rhine valley above Basle, over the Black Forest, and down the valley of the Danube beyond Sigmaringen eastwards (joining the glaciers from the Bavarian Alps) as far as Munich, far out into the plains of Lombardy on the south, the moraines of the mighty Alpine glaciers of the Pleistocene age can be recognised. In some places the moraine rests on marine Pliocene beds; and there are reasons for believing that in several directions the glaciers reached the sea, as those of Greenland do now. The Great Ice Age, whose stupendous records thus remain, was not continuous. In interglacial periods the ice retreated, and allowed an abundant vegetation to flourish, even in the heart of Switzerland. The strata belonging to these milder periods overlie the moraines of more ancient glaciers, interstratified with sands and river gravels, and are in turn surmounted by erratic boulders, the product of a later glacial era.

With these Pleistocene pages, bringing the history down to within perhaps a hundred thousand years of our own time, our study of the Alpine record may well cease. It is but one set of books, one set out of many of like nature, some promising to be more striking still in their teaching when they have been fully studied. Other mountain ranges speak of still more stupendous processes of formation, and even of vaster time-intervals. Others, less massive, speak nevertheless of a more venerable age, since they have now gone far upon their road to decay. Others, although they have become mere wrecks, are yet more interesting as being the earth's most venerable antiques.

The hills are indeed "everlasting," viewed as men must view them. Even as the stellar regions are for us practically infinite, so do the records of the earth run over periods which are for us practically eternal. Yet in another and a grander sense the everlasting hills are evanescent.

> They flow
> From form to form, and nothing stands;
> Like mists they melt, the solid lands—
> Like clouds they shape themselves and go.

GEOLOGICAL ARCHITECTURE.—A curious effect of the wear and tear to which the earth's crust is ever being subjected is exhibited in the singularly capped pinnacles existing on the South River in the Wahsatch Mountains. There are hundreds of these slender pillars, ranging in height from forty to 400 feet, most of them crowned by large caps of stone. They are not works of human art, as might almost be imagined, but are the memorial monuments of the once rounded hills, from which they have been cut by the action of air and water. These pinnacles alone remain of some square miles of solid rock, which has been washed away to a depth of 400 feet. The greater hardness of the surface has caused it to resist corrosion more than the underlying rock, thus leaving the huge stone caps perched high in air on the points of the thin columns. At one point, while this carving process has been going on, a thin wall of rock was penetrated, leaving a lofty natural bridge or arch, which adds to the picturesqueness of a remarkable landscape.

SIMPLE MECHANICAL TRICKS DEPENDING ON GRAVITY.

AMONG mechanical tricks few are more effective than those depending on gravity, and few are more readily managed, the constructions required for such tricks being usually very simple. They are also highly instructive and suggestive. It is indeed easy for the young mechanician, as soon as he has caught the principle on which they depend, to devise new tricks, not less striking than those more familiarly known.

In the first place it should be noted that in most of the mechanical tricks depending on gravity the observer is to some degree deluded; for the selfsame principle of gravity may be illustrated in such a way that the experiment seems natural and ordinary, or in another which makes it appear surprising and even startling.

Take, for instance, the experiment of suspending a weight on a coin standing on edge upon the point of a needle. This is illustrated sufficiently in fig. 1. Two knives K and K′ are thrust into a cork C, into the under side of which, as shown in the figure, a coin, *s s′* (a shilling is the most convenient) is thrust. When this combination is placed in the manner

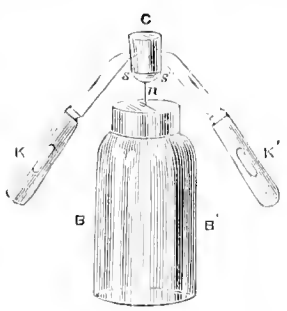


FIG. 1.

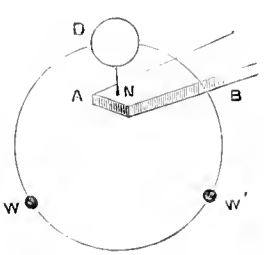


FIG. 2.

shown, so that the under edge of the coin rests on the point of a needle *n*, fixed vertically in any way (as by thrusting it through a cork in the mouth of bottle B B′), the apparently unstable poising is found to be in reality perfectly stable. The knives can be struck so as either to set the balanced combination oscillating or to set it rotating upon the needle's point, without any risk of the balance being destroyed.

Though this experiment or trick has a surprising appearance, the principle on which it depends may be illustrated in practically the same way without causing any surprise whatever; and though this is not the thing specially aimed at in mechanical tricks, yet it is instructive to see how a trick which seems surprising when performed in a particular way resolves itself into a quite ordinary experiment when differently arranged.

This may be done for the trick we have considered by means of such an arrangement as is shown in fig. 2. Here a needle or other sharp-pointed support is fixed vertically into a bar A B, and on the point of this a wire bearing two weights W and W′, and attached in the manner shown to a disc D (which may be a shilling if preferred), is set simply hanging upon the needle's point. In this experiment it is so obvious that the case is merely one of suspension, the equilibrium being akin to the swinging of the pendulum, that the experiment has scarcely even any interest for the observer: he sees at once that the wired weights *ought* to hang freely and safely on the needle's point. But it is obvious that if we remove the part of the wire under the weights, and replace the parts D W and D W by straight wires we have reproduced—without alter-

ing the character of the experiment—the selfsame conditions which produce a more surprising result in the case illustrated in fig. 1.

There is a familiar toy which represents a dragoon mounted on a galloping horse. This horseman may be set prancing on the edge of a table in the liveliest fashion without any risk of an upset, and when so moving seems to present a perplexing puzzle, even though the source of his stability is displayed without any concealment. The horse and his rider are really kept in stable equilibrium by means of a weight at the end of a curved wire which passes from the stomach of the horse downward and backward, so that when the horse is set upon his hind legs at the edge of any support the weight is under the horse's hind feet. In this position the weight is practically as the bob of a pendulum: the only difference is that the weight is connected by a curved wire and the wooden figure of a horse with the part resting upon the place of suspension, whereas the bob of a pendulum is usually at the end of a straight wire. When we set the horse galloping, we set the weight underneath swinging, precisely as we might set a pendulum swinging; and there is no more chance of the horse upsetting than there is of a well-swung pendulum jumping off from its place of support.

A number of experiments akin to the galloping dragoon may be devised for exhibition without any special apparatus. Take for instance a heavy handled carving fork, a cork, a strong needle, a flat-headed nail, and a piece of wood, dealing with them as shown in fig. 3. The nail is driven into the piece of wood W, the fork F is driven into the cork C, through which the needle $n\,n'$ is thrust. The fork,

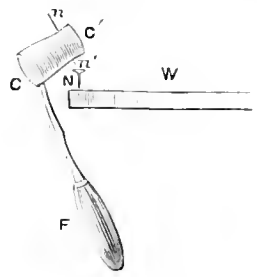


FIG. 3.

cork, and needle may then be safely set swinging on the needle's point, which rests on the top of the nail, the piece of wood being held horizontally as shown. The movement, as the fork swings, is really that of a weight hanging from a point of suspension, and is seen to be obviously stable as soon as its true nature is considered. Yet it has a strange effect to see the apparently unstable combination swaying on a nail top, and on no better point of suspension than the end of a needle.

In the last experiment the nail and piece of wood are not necessary. A fork taken from the dinner-table, and a cork probably found "handy by" (for even in these days of prohibition persons who can trust themselves and their company not to get intoxicated, occasionally have such an infernal machine as a bottle of champagne, port, sherry, or burgundy opened at their table), will, with a strong pin or other representative of the needle, serve the purpose of the experimenter sufficiently. The combination can be set swinging with the pin point resting on the flat handle of a spoon, or even, if the experimenter is handy, on an end of one of the prongs of a silver fork.

Still simpler ways of showing the same illustration of the point may be suggested. Thus take a lead pencil, rather bluntly pointed, and a parlour fire-poker, and tie the middle of the pencil (say two inches from either end) to a part of the poker two inches from the working end. Then bringing together the large end of the pencil and the end of the poker, set the point of the pencil on the edge of the table in the manner illustrated in fig. 4. Then P, where the poker and pencil meet, can be depressed so as to set poker and pencil swinging on the point p' of the pencil, with perfect freedom from all chance of an upset. In this form the trick

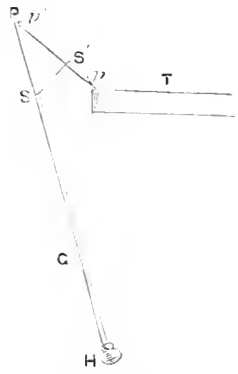


FIG. 4.

is particularly effective because the string $s\,s'$, which replaces the rigid attachment of the other cases, seems insufficient to make the connection between the suspended body and the point of suspension p' effective; and the pencil and poker are known to be free from any attachment at P p. Yet when the poker is set swinging it is easy to see that the pressure at P p' and the tension along the string $s\,s'$ make the connection between the weight suspended and the point of suspension sufficient as against all the forces which are in operation. The weight of the pencil and poker together acts vertically downward through the centre of gravity G, and since this is below the point P the equilibrium is stable. G oscillates under P, precisely as the bob of a pendulum swung from P would oscillate.

In these experiments we have simply a suspended body, so shaped that when it is poised the centre of gravity is hanging below the point of suspension. Thus every movement given to the balanced body raises the centre of gravity above its lowest portion, just as any movement given to the bob of a pendulum raises it in greater or less degree. The swinging motion illustrates the tendency of the centre of gravity to seek the lowest position which it can attain. This is the secret of all experiments in equilibrium. In cases of stable equilibrium the centre of gravity tends to rise under the action of external forces, and the force of gravity brings it back, the body oscillating like a pendulum around the position of rest; in cases of unstable equilibrium it will be found that the action of external forces tends to depress the centre of gravity, to which movement gravity lends its aid, in such sort that the body moves farther and farther away from the position in which it had been unstably poised. The trick in the experiments above described consists in so arranging matters that a position of stable equilibrium is made to look like a position of instability.

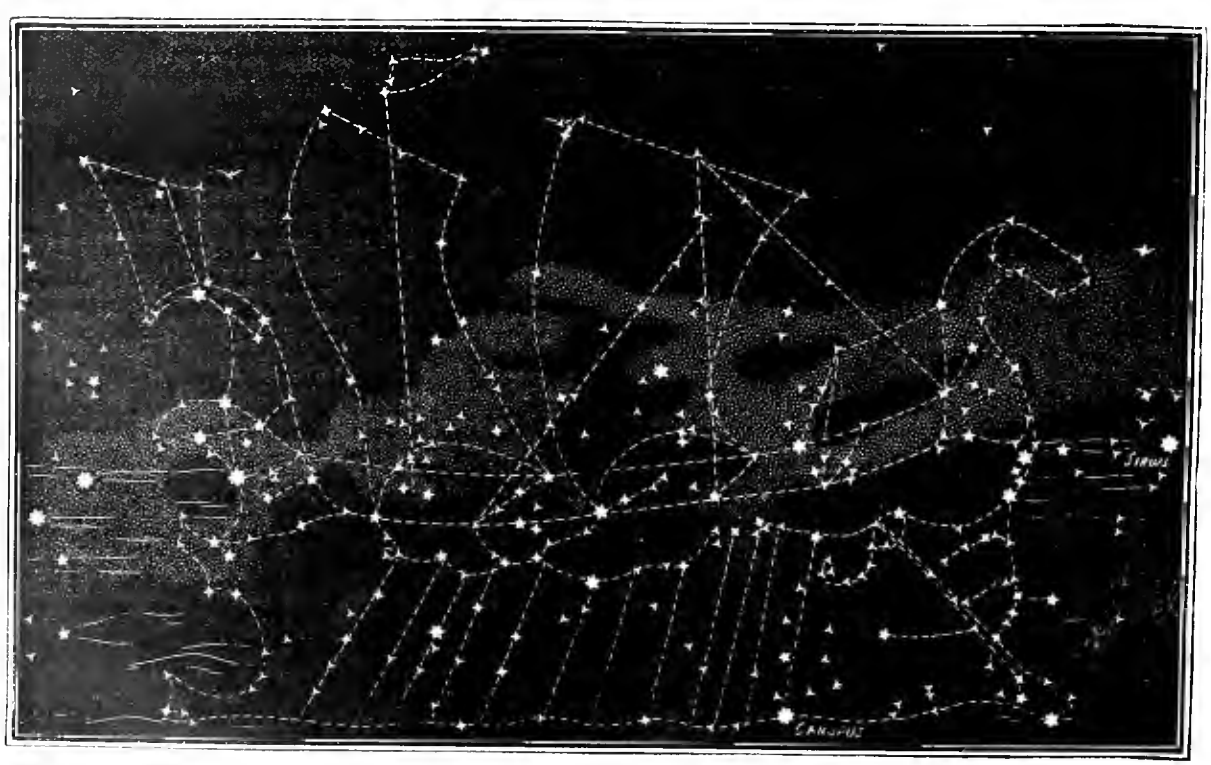
(To be continued.)

THE well-known firm of W. Watson & Sons, of 313 High Holborn, occupied a very important position at the late Crystal Palace Photographic Exhibition, and their exhibits attracted considerable attention from the trade and amateurs alike. They were awarded two medals, one of them for cameras and fittings (with special commendation for the introduction of interchangeable parts) and the other for tripods and studio stands.

MESSRS. MARION & CO. were also very successful, and obtained a medal for appliances for artificial illumination, another for mounts, a third for albums and cases, and a fourth medal for general appliances and plant.

THE DRAGON AND THE GREAT SHIP.

THE two pictures representing the ancient constellations of the Dragon (including the stars now belonging to Ursa Minor) and the great ship Argo (including the stars now belonging to Canis Major, in part, Piscis Volans, &c.) will be found to illustrate my remarks about the "Stars of Other Times" (in KNOWLEDGE for April, &c.).



THE PLANET MARS.

A MAP of this planet is preparing, which will appear next month. The work of comparison between the many hundreds of drawings of the planet available for study has taken a longer time than anticipated. But the map will be ready now very soon.

In the meantime I would call the attention of observers to the excellent opportunity they now have for studying the feature which Schiaparelli attributes to "double canals."

I have accepted as the best available explanation of the observed appearances, that the rivers on Mars observed under different conditions account for all observed appearances.

First. If, as is probably the case in the winter of either hemisphere of Mars, there is much cloud over a Martian continent, the rivers on that continent would not be discernible at all.

Secondly. If, as is probably the case, for some time before each equinox the clouds clear away from a continent on Mars but still hang over the Martian rivers on that continent, they would cause the rivers to appear like silver threads of exceeding fineness if Mars could be seen as he is. But in a telescope even of great aperture the points of light along the river would be seen as diffraction discs, each surrounded by a ring of definite diameter; and the combination of all these diffraction discs would form what would look like a relatively bright streak bordered by two dark streaks (corresponding to the dark spaces around each diffraction disc). [The relatively bright streaks corresponding to the bright rings would not be recognised as bright streaks, being merged in the light background of the Martian continent.]

Thirdly. When the clouds were cleared away from a Martian continent, and also from the rivers upon it, which must often be the case during Martian summer, the rivers would appear like dark streaks—of course much broader than the rivers really are, because the image of a point along one of these rivers is not point-like, even with the most perfect telescope.

All that has hitherto been observed by Schiaparelli, Perrotin, Thollon, and others corresponds with the theory here advanced. (It was first advanced by me in the *Newcastle Weekly Chronicle* very soon after Schiaparelli announced his startling discovery of the Martian double canals.)

What is now wanted is a series of observations of Mars near the autumn of the northern hemisphere (on which most of the "double canals" have been seen). Mars will pass the equinox (autumnal for his northern hemisphere) on or about August 6, and will be well placed for this particular research during June and July.

It will hardly be necessary to remind observers that they should carefully try the effect of varying the aperture of the telescope they may use. If the "double canals" are phenomena of diffraction they would be best seen with a certain aperture, such as would give to the dark ring round the diffraction disc of a star a diameter equal to from a tenth to a twentieth of the diameter of Mars. If the space between the "double canals" be found to correspond with the span thus resulting for a given aperture, the diffraction interpretation of these phenomena would be confirmed; if the space varied with varying aperture, and in accordance with the known relations between the aperture of the object-glass and the size of the diffraction disc, that interpretation would be established.

THE NEW ASTRONOMY.*

PROFESSOR LANGLEY (we hope we are right about the title, but our author's title-page mentions nothing which in England would be regarded as implying professorship) gives as the *raison d'être* for his book the desire to reach those members of the community on whose support the endowment of research chiefly depends. He has written, he says, not for the professional reader (whatever that may mean—in England professions are very various), "but with the hope of reaching a part of that educated public on whose support he" (presumably the "professional reader") "is so often dependent for the means of extending the boundaries of knowledge." This vague purpose may be a sufficient reason for the shortcomings of the book before us. Professor Langley evidently has a very poor idea of "that part of the educated public on whose support, &c." But whether this be so or not, the mere idea of the endowment of research has long since been made to "stink in the nostrils" of the British public. Professor Langley himself has passed from a fairly salaried position with splendid opportunities (of which he has well availed himself) for independent research to a position much better salaried, but without those opportunities. We propose, then, to examine his book with strict reference to its worth, and without considering (what in a different connection we would consider with enthusiasm) his undoubted services as Director of the Alleghany Observatory to the cause of original research.

In the first place, we note that "the educated public on whose support" he depends would seem to be regarded by him as better able to judge appearances than so mere a trifle as intrinsic value. Or it may, perchance, be his publishers, Messrs. Ticknor & Co., of Boston, who suppose that the public will be content with the weight of paper and binding supplied them, without considering the amount of information conveyed, or of new thoughts suggested. Be this as it may, Professor Langley's book is amazingly heavy for the number of pages it contains, and better suited for the desk than the hand—save of the athlete to whom the raising of 56 lbs. at arm's length is a pleasing exercise. The cover positively creaks as it is opened, so stoutly and strongly (and, alas! so heavily) is it built. Sterne objected to the application of rule and square by the critic to the books he may have to consider; but in the case of the book before us, such points as weight and structure force themselves upon the reader's—or rather the holder's—attention. We find that "Professor" Langley's "New Astronomy" weighs rather more than Sir John Herschel's "Outlines of Astronomy" and Mr. Clodd's "Story of Creation" together. This is a serious matter. Without rushing at once to the conclusion that we can in such cases adopt the idea conveyed in the famous epitaph—

> Lie heavy on him, Earth: for he
> Laid many a heavy load on thee,

or insisting with the Greek philosopher of old that a big book is a big evil, we may at least ask whether the importance of the contents, in this case, corresponds with the weight of the book. It may be temper resulting from wrist-weariness, or it may not, but we are moved to say that the number of pages in Professor Langley's book is surprisingly small compared with the weight; the quantity of matter surprisingly small compared with the number of pages; the amount of astronomical information amazingly small compared with the quantity of matter; the proportion

* "The New Astronomy." By Professor S. P. Langley. (Boston: Ticknor & Co.)

of original matter singularly small compared with the number of statements; and, lastly, the ratio of the true to the new even more startlingly insignificant. The most striking statements in the work are that the sun is much hotter than any except Ericsson, Secchi, and Zöllner have imagined, and the moon under her midday sun much colder, for neither of which statements is a particle of evidence vouchsafed (probably because "that part of the educated public on whose support, &c.," is not supposed to be capable of understanding anything so highflown as evidence). We venture to maintain the superior probability of the accepted doctrine on both points, though as Professor Langley professedly eschews mathematics and expresses even contempt for them, we cannot explain our reasons for preferring the law of Dulong and Petit to that of Newton (where the excess of temperature of the radiating body is considerable).

By the general public in America, the style of writing adopted by Professor Langley is, we understand, considered pleasing and attractive. We take a passage at random to illustrate American tastes (if we are rightly informed) in such matters. Mr. Langley is talking about the November falling stars:—

"If the reader will admit so rough a simile, we may compare a flight of these bodies to a thin swarm of swift-flying birds—thin, but yet immensely long" (strange birds!), "so as to be, in spite of the rapid motion, several years in passing a given point" (still, we must repeat, these are strange birds!), "and whose line of flight is cut across on the 13th of November, when the earth passes through it" (that is, through the line of flight of a flight of these bodies). "We are only there" (where?) "on that day, and can only see it" (what?) "then, but the swarm is years in all getting by" (*sic*), "and so we may pass into successive portions of it on the anniversary of the same day for years to come. The stars appear to shoot from Leo only because that constellation is in the line of their flight when we look up to it" (but whether "it" is the constellation, or the line, or the flight, Professor Langley does not say), "just as an interminable train of parallel flying birds would appear to come from some definite point on the horizon." (Can we confidently conclude that an interminable train of parallel birds, whatever parallel birds may be, would *necessarily* appear to do anything in particular, unless something more definite about their interminable trainery is indicated for our guidance?)

One of the strangest things in this treatise on "The New Astronomy" is, that whereas the subject would seem too large even for a work as capacious as Herschel's "Outlines of Astronomy," in *this* work, which contains less than a fourth as much letterpress as that noble treatise (though it is priced at half as much again), the author seems constantly concerned lest each single thing he has to tell "that educated part of the public on whose support, &c.," should not occupy an adequate amount of space (not to mention his anxiety to introduce matter wholly irrelevant). Here, for instance, is the way in which he spins out the stale old story of Galileo's anagram about Saturn (we can afford no larger type):—

"When Galileo first turned his glass on Saturn, he saw, as he thought, that it consisted of three spheres close together, the middle one being the largest. He was not quite sure of the fact, and was in a dilemma between his desire to wait longer for further observation, and his fear that some other observer might announce the discovery if he hesitated. To combine these incompatibilities" (*sic*), "to announce it so as to secure the priority, and yet not announce it till he was ready, might seem to present as great a difficulty as the discovery itself" (we are not joking: every word of this is in the text!); "but Galileo solved this, as we may remember, by writing it in the sentence, 'Altissimum planetam, tergeminum observavi' ('I have observed the highest planet to be triple'), and throwing it, in the printer's phrase, 'into pi,' or jumbling the letters which made the sentence into the monstrous word—

SMAJSMRMJLMEBOETALEVMJPVNENVGTTAVJRAS,

and publishing *this*, which contained his discovery, but under lock and key.* He had reason to congratulate himself on his prudence, &c., &c."

* Mr. Proctor in "Saturn and His System" had a whole volume as large as "The New Astronomy") to give to Saturn, yet we find that all the story told by Mr. Langley from "He was not quite sure" to "under lock and key" (134 words, counting the anagram as 1) is conveyed in 53 words as follows:—"He announced the supposed discovery to the world of science in the form of an anagram produced by transposing the letters of the sentence: 'Altissimum,' &c., 'I have observed that the most distant planet is triform,' adopting this fanciful plan to prevent other astronomers from claiming the honour of the discovery."

Even this, however, is far from being the worst example of attenuative expansion in this ingeniously constructed work. As to space-filling, we have full-page pictures of a cracked glass globe, a shrivelled hand, a falling man, a lightning flash, a scene from the Bessemer works, Professor Langley's camp at Mount Whitney, Vesuvius during eruption, and other non-astronomical matters. Thirty-one full-page pictures in the book are printed as plates (most of them being quite unworthy of any such distinction), yet counted in the paging. But for this ingenious device (which we have never seen in any book of the sort printed out of America), Professor Langley's book, which seems to contain 250 pages, would show but 188.

Professor Langley is an excellent observer in certain departments of physics (despite his weakness—and worse—in matters mathematical), and has done work which has been highly and justly valued; but he has not treated his public with respect, or the publishers of the "Century Magazine" (for whom the essays gathered into this volume were written) with fairness. There are five or six good (but by no means new) pictures in his "New Astronomy," and about two pages of matter at once sound and originally suggestive; all the rest might have been presented in about fifty pages, including cuts.

The "New Astronomy" is strongly though not handsomely bound, and well printed on singularly stout and glossy paper—but, on the whole, we feel sorry for "that educated part of the public" (presumably the American public is meant) "on whose support, &c. &c.," if the opinion which Professor Langley and his Boston publishers appear to have formed of their capacity is just. We believe, however, that the general public in America, as well as in England, want the cream of science, and will not be content with a sky-blue dilution; and we are sure that no devices of printing and binding will make Brother Jonathan regard a little treatise as a large one, though it be "fixed" as a large volume.

SHAKESPEARE AND DONNELLY.

APOLLO AND THE MUD-DAUBER.

MR. DONNELLY has enabled even the dullest to see what sort of value is to be attached to his critical comments on Shakespeare's work and personality. For at length he has published some of the products of his cryptogamic cyphering—products with which neither Shakespeare nor Bacon, but Ignatius Donnelly alone, has had anything to do.

With regard to the legitimate criticism in Mr. Donnelly's book, we note only that it contains no new idea from beginning to end. The argument based on parallel passages is too puerile for comment, though we can believe that any one knowing little of Elizabethan literature may honestly believe that the resemblances are striking. The now notorious cypher, like all such inventions, is one by which anything whatever could be proved. With four root numbers any one of which may be taken, as many modifiers, the power of counting words on any column of any page, from the top or from the bottom, with or without bracketed words, with

hyphened words counted separately or as one, and other variations which Mr. Donnelly allows himself, he can, of course, find everything he wants to find. We must take what he finds as what he tells us that he wanted to find, as what he himself has conceived. Even as our "Benvolio" finds in what Shakespeare wrote evidence of what Shakespeare thought, though dramatically presented, so (only with greater certainty) what Mr. Donnelly has evolved out of his more or less moral consciousness about Bacon and Shakespeare tells us what manner of man Ignatius Donnelly is, and with what sort of a mind he has crawled over the memories of England's greatest and best.

We will not follow him. Let any one read but one paragraph of Mr. Donnelly's cypher reading—say that in which he presents Bacon as painfully forcing into a noble play a series of foul insults respecting the man whom (even according to Mr. Donnelly's nonsense) Bacon thought worthy to be regarded as the author of the greatest dramatic works ever known, and he will have read more than enough. Since the time when Mrs. Stowe wrote that atrocious attack on the memory of Byron, nothing fouler has been conceived than Donnelly's picturing of Shakespeare as a decrepit wretch (when little past thirty), eaten up with disease, drunken, besotted, and imbecile.

We decline to consider further this loathsome work, "rank without ripeness, rotten without sun," the product of a coarse and abject mind. There is a passage in Shakespeare which rises to our thoughts as needing but the change of a word or two to express more aptly than anything known to us the feeling with which we have read this hateful production—a disgrace to America and to literature. When Iachimo has pictured Posthumus Leonatus as foully as Ignatius Donnelly has pictured Shakespeare, and has then as plainly shown the cloven hoof, Imogen says to him what every clean-minded Englishman should say to Donnelly:—

> Away!—I do condemn mine ears, that have
> So long attended thee.—If thou wert honourable
> Thou would'st have told this tale for virtue, not
> For such an end thou seek'st,—as base as strange.
> Thou wrong'st a gentleman, who is as far
> From thy report as thou from honour.
> . . . If [England deems] it fit
> A saucy stranger in [our land] to mart
> As in a Roman stew, and to expound
> His beastly mind to us—she has [a son]
> She little cares for, and her chief glory
> She not respects at all.

NOTES ON AMERICANISMS.

HARM, adjectively for "hurtful:" a Southern usage, claimed by Bartlett for Georgia.

HATCHET. To "bury the hatchet" is to make peace; derived from the Indian custom of solemnly burying a tomahawk when peace is made.

HAULED MEALER. The *Saturday Review* says (and the *S. R.* always knows) that this expression used for persons carted to and from the fields for their meals is an Americanism, and one worth knowing. Striped pullers for members of a London rowing club wearing striped jerseys would be as reasonably included among Cockneyisms.

HAZE, To. The most characteristically American use of this word is that which associates it with the ill-treatment of freshmen by the higher classes. Collegians in America seem to be about as foolish in such matters as lads at our public schools. Certainly our universities now offer nothing which corresponds to "hazing;" and though 'Varsity men are fond enough, and too fond, of noise and fun, the particular combination of brutality and cowardice known as "hazing" in America is unknown in our colleges, and regarded as disgraceful (though not quite unknown) in the army and navy.

HEFT, for weight, though used in parts of England, is oftener heard in the States, and may fairly be considered an Americanism. The same may be said of "heft" used as a verb, in the sense of "taking" the weight of anything. Mr. Bartlett includes "heave," used for "throw," among Americanisms, but there is hardly a part of England where this usage is not familiar.

HEFTY. Heavy.

HELP. This word for "servant" is of English origin, but it has undergone a singular change. Of old a "help" was one who helped the servants, the term implying inferiority. Now the word "servant" is objected to as degrading, and "help" is used in its place. To the word "servant," regarded as derived from the Latin, there are objections akin to those existing against the word "subject," seeing that the so-called servant is no more a slave than the so-called subject is in real subjection. The word "help," however, is but an unsatisfactory substitute.

HERB. In England it is permissible to aspirate the "h" in this word, though probably the word is oftener pronounced 'erb. In America it is never aspirated.

HICKORY. Owing to the toughness and hardness of hickory (a species of *Carya*), the word is often used as equivalent to tough, hard, or resolute. General Andrew Jackson was called "Old Hickory" because of his firm and resolute character. Yet the word sometimes means flexible—hickory being capable of bending without breaking. A "hickory bend" means a bend which only some substance like hickory can take without breaking. It is used in surgery of bones which, under a severe blow, have bent yet not broken. Those who would wish to prove that the Indians came from the East may find an argument for the theory in the rather curious circumstance that the Greek name for the species to which the hickory belongs—ἡ καρύα—is almost identical in sound with the Indian word from which "hickory" was derived.

HIGH FALUTIN. High-flown, derived by Hotten from the Dutch *verlooten*, but by Bartlett and others from "high flighting," a word which needs accounting for as much as the other.

HIRED MAN, or woman, or girl. One who is hired for work: see "Servant."

HITCH. To hitch together, or hitch horses, is to get along well together.

HOE ONE'S ROW, To. To do one's share of a job.

HOG-WALLOWS. Places in the western prairies which look as though hogs had wallowed in them and torn them up. But hogs in reality have had nothing to do with them. Cracks form in the prairies during the droughts of summer (usually where the prairie is level), forming hexagonal patches eight or ten feet in diameter. During the heavy rains which follow the earth gets washed into the cracks, and after several years peculiarities of contour arise which present the appearance attributed—unjustly—to the wallowing of hogs.

HOME. The "old home," used for the old country, shows that even to this day some Americans remember that America was colonised by Englishmen, was rendered independent through the courage and energy of Englishmen, and is in point of fact of English production. If all Englishmen and all Americans remembered this, we should not so often hear either Englishmen or Americans speaking ill of each other.

HOMINY. Coarsely ground Indian corn, boiled.

HOMMUCK or HUMMOCK. See "Hammock."

HONORABLE. This term is applied to members of the

Senate and of Congress, also to members of the State Legislatures. It is retained afterwards for life. Bartlett says the rule is "Once an honorable always an honorable;" but, according to the papers, the rule is not once an honourable always honourable, any more than in Great Britain once a noble implies always noble, though an American politician has a much better chance of being credited with an honourable character when he has retired from the running. Men who, like Garfield, chance to die in office even get qualities attributed to them which were not only questioned during their lives, but which they certainly never possessed. Anything more preposterous than the way in which Americans abuse their "honorables" while they hold office, and afterwards pretend to compare them with Europeans not only honourable but noble in their lives, can hardly be conceived. Notoriety and fame seem regarded as synonymous.

HOODLUM. A Californian word for a rough blackguard, akin to a "cornerman" in Liverpool. Rough, rowdy, larrikin, hoodlum—it would be difficult to distinguish between them otherwise than as the "rough" is English, the rowdy American east of the Rockies, the hoodlum American west of the Rockies, and the larrikin Australian.

HOOK, To. To steal. Those acquainted with the literature of English *argot* will be amused to find Mr. Bartlett classing this word as an Americanism. In Hogarth's well-known cockpit, the method of stealing, from which the use of the word "hooking" for "stealing" had its origin, is illustrated in practice.

HOOSIER. A nickname for native of Indiana. The term was originally used in a disparaging sense to indicate rough frontier ways.

HOPPING MAD, for exceedingly angry, is a common expression among the more vulgar in America. It is not stated by any competent authority that Americans in any part of the States really indicate anger by hopping.

HORSE-FIDDLE. Any instrument constructed coarsely and roughly to be played after the manner of a fiddle, and producing execrable and atrocious noises. In different States different ideas of the best way of making a horse-fiddle prevail. But any arrangement from which, by a process akin to "bowing," a gruesome noise to be heard a long distance can be effectively produced deserves the title. In England this particular form of "horse-play" is no longer in vogue. Some Americans conclude, therefore, that we are behind the times. But we had our brutal noises in past ages (*vide* Hogarth's industrious apprentice—the Charivari), and have got through that form of nonsense—in which, strange to say, even the roughest English folk have long since ceased to find any fun.

HOSE. The modest way of mentioning stockings among the immodest in parts of America, and especially in some of the western States. Some persons are so depraved in their imaginations that to speak of the human legs, or of stockings, or breeches, or other appurtenances of the understanding, suggests (so far as one can judge by their talk) all sorts of gross ideas. It is among these, unfortunately far more numerous than Americans of the more decent sort imagine, that the false delicacy ridiculed by travellers in America had its origin. It is a pity, because visitors in America often have no idea what nastily minded folk they may meet in society otherwise perfectly respectable. Offence has been unwittingly given, again and again, where no offence had been intended or even imagined. And, oddly enough, the persons thus astoundingly "nasty" consider themselves exceedingly "nice." They retain their sense of offence for years after the innocent event which caused offence has passed away, and talk of the offender, who in the meantime remains perfectly innocent of his offence, as if he were a blackguardly fellow who did not know how to address properly minded people.

HOSS for "horse," and especially as a slang title for a person of great courage, resolution, and strength, may be regarded as an Americanism, though it is sometimes heard in parts of England. There is a ridiculous story about an American actor who represented Richard III., in Shakespeare's play of that name, which curiously illustrates the use of this term. "He came down to the footlights," said the enthusiastic narrator, describing the death scene—"he came down to the footlights—yes, sir!—and he wrapped the star-spangled banner around him, and died like the son of a hoss." Higher praise could no American give.

HOUND. Although the word "hound" is in use in America as in England for a term of reproach, as also is "dog," you may use the word without offence in American society: but to use the female name for the species, even in talking about dogs and sport, is regarded by persons of the kind described under "hose" as an offence of the first magnitude.

HOUNDS. A name very appropriately given to a gang of cowardly ruffians, akin to "white caps," "vigilants," and other such villains, who banded themselves together under the pretence of "regulating" immigration into California in the old days of 1849. It may be hoped that most of them were in the long run shot or hanged, as they deserved.

HOW? Pronounced *haow*? This interjection used for *what*? and intended as an abridgment of "how's that?" (for "what did you say?"), is very often heard in New England, and not unfrequently (owing to intermixture) in other States. It has a vulgar sound, more marked, I imagine, in the ears of cultured Americans, who have learned to associate it with inferior culture, than with us English folk, who simply regard it as an amusing Americanism.

HOW D'YE? Pronounced "howdy"—Southern for "how do you do?"

HOW'S THAT FOR HIGH? Bartlett absurdly puts as the equivalent for this quaint expression—"What is your opinion as to the height of it?" He might as well have said that it signified "How many inches, ascertained trigonometrically, does it span in a vertical direction?" The expression is always used in a quaint and half-ironical manner. For instance, a man will show a picture in flaming colours, and with glaringly grotesque figures, and ask "How's that for high?" Or he will ask the question after reading some absurdly grandiloquent passage in a speech or description.

HUB. Boston is commonly known in America as "The Hub"—short for Hub of the Universe. (How's *that* for high?)

HULL, for "whole," a pronunciation often heard in the States.

HUMAN, A = a human being.

HUNKEY = capital, first-rate. A "hunkey boy" would correspond to our English "no end of a brick," and the Irish "broth of a boy."

HUNKY DORI, or HUNKYDORUM; something superlatively good.

HURRY UP, To. Americans say "to hurry up" where we say "to hurry." I remember the first time I heard the expression it considerably startled me. In those days it was customary for the railway conductors to go round collecting tickets in the sleeping-cars at all sorts of unearthly hours in the night. My ticket was asked for about 4 A.M., and I was feeling for it through my pockets, when the conductor called out impatiently, "Hurry up!" "Why, I thought we did not get into New York till seven?" I said, stopping in my search for the ticket to attend to the more serious business of getting up. "Oh, shucks!" was his polite reply; "hurry up with that ticket."

HUSH UP. This expression is equivalent to our English "Shut up," or to the American "Give us a rest."

HYPER, TO. To hurry, or, as Americans say, to "hurry up."

HYPO. for "hypochondria," is probably English, but I have never heard the word except in America.

HYST, for "hoist," is sometimes used in America to describe a "fall," but (a distinction Bartlett fails to notice) only a fall which is so violent as to be followed by some sort of rebound. It is the rebound, not the fall itself, which is the "hyst."

ORIGIN OF LIFE.

A NAVAJO TRADITION.

THE Navajo Indians of Arizona have a tradition to the effect that while the earth was young and destitute of animal life the Great Spirit created twelve people—six men and six women—together with many species of animals, and confined them in a cavern of the San Francisco mountain, where they lived as a great happy family for many years. But in course of time a restlessness possessed the prisoners. Though they had known nothing of freedom, all felt the oppression of their narrow limits, and vaguely yearned for a greater fulfilment of the dream or reality of living. But what could they do? All speculated on the situation to no purpose. Daily they jostled each other, little and big, clumsy and nimble, bipeds and quadrupeds, feathered and furred, winged and wingless, timid and bold. Every successive period of time was but a repetition of the past.

None of the many puzzled brains could offer means of breaking the monotony, till a happy thought struck one of the most insignificant of the living mass. For want of other occupation a locust bored a hole in the wall and thereby opened the way for the enthusiasm and progress of the host of its comrades throughout the length and breadth of their underground world. The Great Spirit had so decreed it. They were there only for a time of incubation. At the destined hour, as the eaglet bursts the shell that imprisons it, so the locust's tiny burrow should lead to the escape of all into the open world, where each could follow his inclinations unhampered.

The labouring locust had but a solitary witness. A badger watched with growing amusement the diminutive tunnel-making. His eyes sparkled with interest as the locust laboured energetically. He lay resting with his head between his fore paws in a most lazy attitude, but his face expressed animation and eagerness not much longer to be retained. As the tail of the locust disappeared the time for exertion had come. To follow the locust's movements further necessitated like energy. The locust's hole was too small for the badger's access, so he started a tunnel-making of his own. By the time he reached the locust he was in no mood to give up the chase, so he passed on, scratching his way through the solid earth until he broke through the outer crust of the mountain, and in the joy and excitement of the moment he sprang into the ample space before him. The mountain side was steep, and he "landed" in the shallow edge of the lake in Montezuma valley. As he fell his fore feet struck deep into the mire, and his progeny even unto to-day have inherited black fore paws because of this incident of the world's first peopling.

The Navajoes within the cavern, noting the departure of the badger, began a "prospect." Finding the hole large enough for exit, they crept out, one after the other, and a train of all sizes and species of animals followed in their wake, as from Noah's ark.

As soon as all the prisoners were free, fire and smoke began to issue from the hole that had delivered them. This frightened them far away into the valley, and there they prepared to make themselves comfortable and live as their new advantages permitted. Food was plentiful in vegetable forms, but some varieties needed heat to make them good. At least the Navajoes thought so, but they had no means of kindling a fire. This difficulty was soon overcome by sending a bat, a wolf, and a squirrel after the needed element, fire. Going to a hole in the mountain, the wolf tied some pitchy splinters to his tail, then turned and held it over the little volcano till it began to smoke and ignite. The bat then fanned it into flames with its wings, and the squirrel carried it away to the Navajoes. The people were delighted of getting the one missing essential to a happy life in the open world, and when, long after, a time came when the world's plenty had pampered their wills and fostered their greed and selfishness to the point of preying upon their fellow-creatures for food, they still had the honour to vow never to eat wolf or squirrel flesh. Neither would they move camp without a live coal among their possessions. And even to-day the Navajoes' gratitude to the trio is observed as the promise made to the fire-getters of the tradition.

Between the Navajoes and different animals there sprang up a dispute over the Great Spirit's intended use for night and day. All agreed that one should be spent in sleep and one in action, but which should serve the one and which the other? It was settled at last. Those that wished to roam at night should do so and sleep by day, and *vice versâ*. The heroic badger was among those who chose the mysteries of the darkness or the immediate dawn and dusk for thought and action, and the bright and sunny hours as fit to be slept away in his cool underground nest. As the sun sank in the west upon their business meeting, the owl, bat, moth, and many other animals scattered out into the valley borders on their foraging exploits, while many kinds of birds flew to roost in the trees. Other animals lay down to sleep in sheltered parts of the forest, and the Navajoes spread their waterproof blankets, the trophies of the women's industry, and enjoyed their couches under the starry sky in peaceful dreams.—*Overland Monthly.*

Gossip.

By RICHARD A. PROCTOR.

I HOPE to visit England next September, for the winter of 1888-89. Any institutions, societies, &c., or individuals who may wish for lectures from me should address me (without great delay) at Corona Lodge, Orange Lake, Fla.; or communications may be addressed to Mr. John Flack, care of the publishers of KNOWLEDGE.

* * *

A CORRESPONDENT mentions that in a certain game, in which the chances were even, one player won nine times in succession. He and his friends discussed the matter, and one of them afterwards calculated that the odds were 511 to 1 against the observed event. He asks me if this is right. It is, if the question is, What are the odds against one named player winning nine successive games, counting from the one first to be played? If, however, the question be, What are the odds against one or the other player winning the first nine games played? then the odds are only 255 to 1. And if the question be, What are the odds against the occurrence of a run of nine successive wins by one or other player in the course of an evening's play? the odds will be much less—only determinable, however, if the number of games to be played be mentioned.

THE method of calculation is simple. If the first of the above questions is raised, and A be the player whose chance is to be considered, then the chance that he wins the first game is $\frac{1}{2}$, and the chance that he wins the second considered alone is a'so $\frac{1}{2}$; but as he only has $\frac{1}{2}$ a chance of entering on this second game as a winner of the first, his chance of winning both games is only $\frac{1}{2}$ of $\frac{1}{2}$, or $\frac{1}{4}$. So his chance of winning the third game is $\frac{1}{2}$; but his chance of winning it as already a winner of the first two is only $\frac{1}{4}$ of $\frac{1}{2}$, or $\frac{1}{8}$. Proceeding in this way, we find A's chance of winning the first fours game $\frac{1}{8}$ of $\frac{1}{2}$, or $\frac{1}{16}$; of winning the first five, $\frac{1}{16}$ of $\frac{1}{2}$, or $\frac{1}{32}$; of winning the first six, $\frac{1}{32}$ of $\frac{1}{2}$, or $\frac{1}{64}$; first seven, $\frac{1}{128}$; first eight, $\frac{1}{256}$; and, finally, A's chance of winning the first nine games is $\frac{1}{512}$, or the odds are 511 to 1 against that event.

* * *

THE second question only differs in asking the odds against A or B (one of whom *must* win the first game) winning the remaining eight. The chance, as already shown, is $\frac{1}{256}$; the odds, therefore, are 255 to 1.

* * *

IF a number of games are played, it is easy to see that the chances against the event in question are not so heavy. Suppose, for instance, fifty games are played. Then the run of nine games has a chance of occurring with the first nine, *i.e.* beginning with the first game, or with the second, or third, and so on up to the forty-second game.

* * *

THE particular case mentioned by my correspondent—the occurrence, namely, of nine events of the same kind in succession, where the chances are even at each trial—might be supposed to have occurred when Oxford beat Cambridge in the 'Varsity boat race from 1861 to 1869 inclusive. But the probability is that there was a definite superiority in the Oxford style in those days. And it is to be noticed that when the chance is small for an observed event, assuming the conditions equal, the occurrence of the event leads to a presumption that the conditions are not strictly equal, this presumption increasing in weight as the preponderance of events of one particular kind over events supposed originally to be of equal likelihood grows greater.

* * *

THE *Sidereal Messenger* is not content with the progress of events described in KNOWLEDGE for April last under "Gossip," pp. 138, 139. I considered the editor of that usefully compiled little magazine had no right to drag from the columns of the San Francisco *Examiner* (a paper well known for a certain Californian vulgarity) a controversy which began with the unprovoked publication of rude, mendacious things said of me by Mr. Holden in an "interview." If he did drag these improprieties into a magazine otherwise respectable, though dull, he might at least have put in my own reply to the stream of falsehoods which had trickled from Mr. Holden's pen, instead of introducing that stream undiluted by truth. He thus left me no choice but to write a new reply. (I could not at the moment find the only copy I had of the *Examiner* correspondence, and if I had I should not—for reasons—have been very willing to trust it out of my hands except where I knew very certainly that I should see it again.) My brief reply to the *Sidereal Messenger* did not explain, as my full reply to the *Examiner* had done, that the way in which I had saved Holden's name from rejection had been simply by silence. The fact is, as I said last April, it did not seem *absolutely* necessary to explain in one and the same letter that I regarded a person as utterly unworthy of a certain distinction, and that I had *not* actively supported his name for that distinction. It did not seem to me possible that any man having a modicum of sense combined with some idea of the ways of men of honour would misunderstand so preposterously my remark, that the name of one whom I had described as unworthy would have been rejected with contempt had I not spared him.

* * *

THE fact is, I had been so careful in avoiding any mention of the fellow's wrong-doing, from the day when I found out that it was no mere penny-a-liner who had behaved so badly, but one who mixed with such men as Newcomb, Harkness, Hall, Eastman, and others whom I esteem, that I hold myself entitled to some consideration on account of this silence alone. Among those who read these lines there will probably be some of my friends who were on the Council of the Astronomical Society when the election in question took place. They knew that I uttered no word, offered no suggestion, simply did nothing in regard to the person in question. They knew me well enough to be assured that I am neither foolish enough nor false enough to speak of active support, or to imply the support of actual voting on the Council, when ninety-nine out of every hundred who would hear of such statements would know that at the time I had long since withdrawn from all active participation in the Royal Astronomical Society's business, while most of the ninety-nine would consider little short of shameful any active support of one of whom I think as I do of this person.

* * *

YET this Western editor of a miniature magazine of science in remote Minnesota confidently pretends to suppose that I would select his scarce known pages to add a ridiculous and ineffective untruth to the true and just thong-strokes which I have felt it my duty to inflict on a wrong-doer (after finding ten years of silence misunderstood and unappreciated). He asks me to apologise for what I have not said, and for what, had I said it, would have been no injury at all, whether true or not; while he declines (or probably is unable) to see that what I *have* said implies an estimate of his *protégé's* character which would render injury impossible.

* * *

I IMAGINE the editor of the *Sidereal Messenger* is unable to forgive the circumstance that in an early volume of KNOWLEDGE I had to comment on the poverty of original matter in his little magazine (priced at tenpence!). But he has done better with the magazine since; though it is still rather too much of a compilation, and much too small for its price. He ought rather to be grateful than angry for suggestions which doubtless had their share in causing so noticeable an improvement.

* * *

MR. J. FRASER, author of a new and entirely inadmissible theory about gravity, has remained dissatisfied with the treatment he has received in these columns. It will be remembered that his pamphlet was noticed in KNOWLEDGE for August last, p. 236, and that in KNOWLEDGE for October, p. 282, I had to explain in "Gossip," in response to his appeal to myself personally, that the author of the notice had certainly not, as he supposed, acted with wilful unfairness, while I expressed my all but certainty that there was not even any unconscious unfairness. On carefully reading through the pamphlet, I found that, as I supposed, the notice was perfectly just, Mr. Fraser's theory being absolutely untenable. As I had promised to state in these columns the result of my reading of the pamphlet, *if* I found that Mr. Fraser had really made good his case, I supposed that he would take my silence as signifying that I had failed

to find anything of the sort. It appears, however, that Mr. Fraser thinks I must have been satisfied with his theory, but am prevented from saying as much by some mistaken notion about the way in which the editor of KNOWLEDGE should back friends who had written in these columns, even though he judged them to be wholly in error. So he writes to a gentleman whom he supposes, quite erroneously, to have been acting editor of KNOWLEDGE as well as author of the notice of his pamphlet, in terms implying that he has been most unfairly treated.

* * *

Now all this is in exceedingly bad taste—to put the matter very mildly indeed. If my friend had been both author of the notice and acting editor of KNOWLEDGE, it would have been quite improper to address him personally about a notice which he had written in discharge of duties which belonged to the position he occupied. (To appeal to me, as Mr. Fraser had done earlier, was still worse; but, as I had heard the appeal, and had indicated my opinion, to renew the charge of unfairness was doubly insulting—insulting alike to me and to my friend.)

* * *

If paradoxists choose to send their lucubrations to KNOWLEDGE, they must accept the opinions expressed here about them as decisive so far as KNOWLEDGE is concerned. They are free to go about denouncing KNOWLEDGE as incompetent or unjust. If they can make their theories acceptable to the scientific world, their abuse of KNOWLEDGE will very likely be accepted along with those theories. But they have no right to send their abuse to us as well as their paradoxical pamphlets, or to complain because we have given the opinion they have shown themselves anxious to obtain.

* * *

I do not feel bound to repeat or explain my opinion or the opinion of my friend who noticed Mr. Fraser's pamphlet. But as it seems he is not satisfied that I really think his theory unsound, and as he evidently believes I have not noticed the arguments by which he considers he has met objections, I may as well tell him that I do and have. He regards "heat" as the cause of gravity, and cannot see that what we know about the nature and rate of transmission of heat is entirely inconsistent with what we know about the nature and especially about the rate of transmission of gravity. He makes a wild yet feeble attempt to show how heat would act *through* the planets and suns, coming out on the other side; and he supposes he has made it clear that the influences (purely imaginary) which he attributes to heat-waves would be proportional to the masses, not to the surfaces of bodies producing them; but the proof does not merit serious disproof. He has an idea that the great difficulty about gravity resides in the shortness of the time occupied in traversing the distances between the heavenly bodies, so he triumphantly points out that no time at all would be required by his bombarding waves to reach the bodies acted upon, since they are travelling about all the time. The question is not one of time, however, but of velocity. It takes no time for a person travelling along in a rain storm to receive the rain which he encounters at the moment of his arrival at any place: yet his velocity combines with the velocity of the falling rain to affect the apparent direction in which the rain falls on him. What we *know* about gravity is that the velocity of its transmission almost infinitely exceeds the velocity with which the planets travel, and is *many times greater than the velocity of light and heat.*

* * *

Reviews.

The Geological History of Plants. By Sir J. W. DAWSON. (Kegan Paul, Trench, & Co.)—This is a valuable addition to the International Scientific Series. An introductory chapter is fitly occupied with the general facts of geological chronology and the classification of plants, while the body of the work supplies in convenient compass a summary of the development of the successive floras, the typical vegetation of each period being admirably illustrated. We may direct special attention to those portions of the seventh and eighth chapters which, in treating of plant origin and migrations, discuss the interesting question of the appearance of specific types in Arctic latitudes, "the full significance of which," Sir William Dawson remarks, "seems only recently to have dawned on the minds of geologists." Sir William might have added that the paramount importance of the study of plants, as contrasted with that of animals, in organic evolution, "seems only recently to have dawned" on biologists.

A Course of Lectures on Electricity. By GEORGE FORBES, M.A., F.R.S., &c. (London: Longmans, Green, & Co. 1888.)—This admirable series of lectures is based upon the notes of five which were delivered by Mr. Forbes before the Society of Arts in 1886, while the sixth (on Dynamo-Electric Machinery) is a reprint of a paper read at the Electrical Exhibition at Philadelphia in 1884. As a trustworthy introduction to electrical science, as developed experimentally by Faraday, and subsequently mathematically by Clerk Maxwell, it would be hard to surpass. Plain and popular in language, but throughout scientifically accurate, the fairly well-educated reader who gains his first introduction to electricity through its pages will find, after an attentive perusal of them, that he has acquired a sound knowledge, not only of the principles of the science, but also of the manner in which it is practically applied in electric lighting, the telegraph, the telephone, and in the arts generally. No sounder and better rudimentary treatise on the subject of which it treats has, so far, appeared. Seventeen well-executed woodcuts supply all that is needed in the shape of illustration.

A Student's Manual of Psychology. By FRIEDRICH KIRCHNER. Adapted by E. B. DROUGHT. (London: Swan Sonnenschein, Lowrey, & Co. 1888.)—Wading painfully through this volume, we are amazed that its author can have contrived to render a subject so replete with interest as psychology so horribly dull and wearisome. To read it after perusing such works as Bain's "The Senses and the Intellect" and "The Emotions and the Will," or Carpenter's "Mental Physiology," is like turning from an essay by Elia to "Drelincourt on Death" or Hervey's "Meditations among the Tombs." This is the more regrettable as the author's obvious erudition is supplemented by that thorough plodding painstaking so essentially characteristic of the German scholar. A large part of the dissertation "On the Nature of the Soul" seems to us the veriest logomachy.

The Playground of Science. By JOHNSTON STEPHEN. (London: Truelove & Shirley.)—Every student of physics knows how much more he learns from experiments actually performed by himself than from any amount of mere reading. Acting on this admitted principle, Mr. Stephen, in the capital little shilling's worth before us, gives plain directions for the performance of sixty-nine experiments, illustrating the phenomena of sound, light, heat, electricity, magnetism, pneumatics and hydraulics, statics and dynamics, with descriptions of the mode of constructing the extremely simple apparatus needed for their demonstration. All of

them ingenious and some of them new, these cannot fail to give any intelligent boy or youth sound ideas on the subject of elementary physics, and for this purpose Mr. Stephen's little book may be confidently recommended.

Volapük, or Universal Language. By ALFRED KIRCHHOFF. (London: Swan Sonnenschein, Lowrey, & Co. 1888.)—*Key to the Volapük Grammar.* (Same Author and Publishers.)—Whether a universal language is attainable, or even desirable, may reasonably be a subject for discussion; but that "Volapük" will ever become that language is in the very highest degree improbable. Mediævally, Latin was the means of communication among scholars of all nationalities, as to-day French is the language of diplomacy; but if any form of world-speech is now to be adopted, by far the simplest plan would be to select the existing language spoken by the greatest number of civilised men, and adopt *that* as the common vehicle of thought among the different nations of the earth. It needs no superhuman acumen to determine what that language must, *ex necessitate*, be. Herr Kirchhoff, however, in this matter assumes the attitude of the militiaman, who, being reminded by his left-hand man that he was out of step with the entire battalion, retorted, "Change yourn, then!" We gravely doubt whether he will get many Englishmen to take the trouble to master his grotesque and caeophonous new language, at a time when their own mother-tongue is so rapidly spreading in every part of the habitable globe.

Discursive Essays on the Phenomena of the Heavens, &c., &c., &c. By COSMOPOLITES. (London: London Literary Society.)—An evil fashion has sprung up of late years among book compilers which deserves exposure. It pertains mainly to the school of cosmogonists, and gentry who come forward with theories more or less new (and more rather than less, idiotic) of the physical structure and dominant forces of the universe. These people, unprepared by previous mathematical and physical training, begin by sedulously cramming up the contents of a few books on popular science, whose facts they empty wholesale into their pages; and then, upon this foundation, build their own preposterous theories. If any one ventures to criticise their nonsense, the stock answer is that their facts are irrefragable, as though the granting of this postulate carried with it the admission that their inferences must be also! Of (what we may perhaps call, without offence,) this Kinnsian style of argument (?), "Cosmopolites" is seemingly one of the latest exponents. When we say that he sets forth as an "axiom" that "every atom of matter in the solid, fluid, or gaseous state throughout the entire universe, contains the essence, or principle of heat, of which light is an emanation, a quality, or manifestation" (page 47); that he treats cold as an actual entity and not as the mere absence of heat; that he regards certain aërolites as actually formed in our own atmosphere—and so on, and so forth, we feel that we should not be justified in further trespassing upon our readers' time by any detailed criticism of these well-named "Discursive" Essays.

Lockwood's Dictionary of Mechanical Engineering Terms. (London: Crosby Lockwood & Co. 1888.)—This carefully compiled volume forms a kind of pocket cyclopædia of the extensive subject to which it is devoted, and will be found useful alike to the artificer and to the amateur reader of technical works on mechanical manipulation. No word having connection with any branch of constructive engineering seems to be omitted; and, while we find a short article on the "Occlusion of Gases" on p. 236, the author does not omit to define with equal care, on p. 377, so familiar an object in the workshop as a "Tommy"; the meanings of "Unit of Heat" and "Jim Crow," too, alike finding their places in his pages. No more comprehensive work has been, so far, issued.

The Genesis of Federation. By MAURICE H. HERVEY. (Sydney: John Sands. 1887.)—Mr. Hervey has a magnificent scheme for the federation of all colonies, states, dominions, and dependencies which at present acknowledge British rule; but as it comprehends, *inter alia*, the division of the United Kingdom into four autonomous states of England, Ireland, Scotland, and Wales, we need not discuss it here.

Internationales Archiv für Ethnographie. Band I. Hefte I. and II. (London: Trübner & Co.)—The first two parts of what promises to be a work of the highest value to the ethnographer and anthropologist lie before us. Few persons have any conception of the vast amount of unemployed material in the shape of ethnographical collections which reposes upon the shelves of so many museums, and it is to render this available to the scientific public that the present series has been projected. Each part contains a series of detached essays on the various branches of the subject to which the work is devoted; the principal paper in the first part being devoted to New Guinea, and the corresponding one, in the second, to Liberia. Nothing more beautiful than the coloured illustrations of weapons, instruments, and implements has appeared for a very long time.

The Asclepiad. By B. W. RICHARDSON, M.D., F.R.S. (London: Longmans, Green, & Co. 1888.)—Once again we welcome the quarterly number of Dr. Richardson's excellent and valuable serial. As we have formerly had occasion to remark, while primarily addressed to the medical profession, it is almost impossible to find a part destitute of matter of interest to the ordinary reader. To take the one before us as an illustration: it contains an article on embalming, and a biographical sketch of the famous Dr. Mead, who introduced inoculation into this country, stood by the death-bed of Queen Anne, and was physician to George II. Assuredly this capital contribution to medical literature exhibits no sign of decadence.

Cassell's Technical Educator. (London: Cassell & Co.)—If we are to accept the loudly-uttered assurance that the future commercial salvation of this country depends upon the spread of technical education, then surely the Messrs. Cassell deserve our gratitude for their efforts for its advancement. Nothing more comprehensive than the work before us has, so far, appeared. In fact, were we disposed to cavil, we should be tempted to object that it is really *too* comprehensive, embracing, as it does, fortification! among the extremely diverse subjects of which it treats.

Among the pile of educational books which crowd our table may be mentioned *Physiology*, by J. M'GREGOR-ROBERTSON, M.A., and *Dynamics and Hydrostatics*, by R. H. PINKERTON, B.A., two of Blackie's excellent Science Text-books. (London: Blackie & Son. 1888.) Both well written and illustrated: the *Physiology* excellently and profusely so. *Physiography*, by W. MAWER, F.G.S. (London: John Marshall & Co. 1888); *Elementary Physiography*, by JOHN THORNTON, M.A. (London: Longmans, Green, & Co. 1888), into which, and notably in the case of Mr. Thornton's book, a great deal of information is packed.—*Practical Essay Writing*, by A. W. HOLMES-FORBES, M.A. (London: Swan Sonnenschein, Lowrey, & Co. 1888), containing much that must be useful to the imperfectly crammed competitor in an "Exam."—*A Pupil Teacher's Handbook of Arithmetic*, by Rev. A. D. CAPEL (London: Joseph Hughes. 1888). Cheap and sound.—*French Course*, by G. H. WILLIAMS, M.A. *The Art Student's Second Grade Practical Geometry*, by JOHN LOWRES, revised by GEORGE BROWN *Moffatt's Selected*

Inspector's Arithmetic Questions, Standards III., IV., V., VI., and VII. *Moffatt's Geography of the British Empire.* (London: Moffatt & Paige.) Of which Mr. Williams's work seems to be designed on a common-sense plan, and the others to fulfil the purpose for which they were compiled. Also from the same publishers—*How to Prepare Notes of Lessons*, by T. J. LIVESEY; *The Earth and the Solar System*; *The Ocean*; *How to Teach Reading*, by T. J. LIVESEY; *English Grammar*; and *Time Drill.* All useful to teachers in elementary schools.—From Messrs. Relfe Brothers we have *First Principles of Modern History*, by T. S. TAYLOR; *How to Spell and Speak English*, by M.A. Cantab.; and *Dates made Easy*, by J. H. HAWLEY.—From Messrs. Swan Sonnenschein, Lowrey, & Co., *A First History of the English People*, by AMY BAKER, the second volume terminating with the reign of Elizabeth; and from Mr. David Nutt, *Simon de Montfort and his Cause*, by Rev. W. H. HUTTON, M.A., each of the works specified being a more or less successful attempt to render history digestible to the youthful mind.—*A Plea for Training the Hand* (New York Industrial Education Association. 1888), which might be read with profit by those who are urgent to grossly misuse Board Schools by teaching French, &c., in them; as pointing out a more excellent way of employing the spare time of children who must subsequently live by their own labour.—*Moffatt's Deductions from Euclid.* (London: Moffatt & Paige.) Handy for testing the student's comprehension of the problems and theorems of the mighty Alexandrine geometer.—*Education, Science, Geology.* By H. P. MALET. (London: Farmer & Sons. 1888.) Unworthy of serious criticism; and *Education in Bavaria.* By Sir PHILIP MAGNUS. (New York. 1888.) A clever attempt to persuade the British taxpayer further to endow the South Kensington ring.

Among the literary odds and ends on our table are: *Physical Geography of Mountains and Rivers.* By THOMAS PAIGE. (London: Moffatt & Paige.) Useful to the beginner.—*A National Canal Between the Four Rivers a National Necessity.* By SAMUEL LLOYD. A scheme for promoting English prosperity by uniting the Thames, the Severn, the Mersey, and the Humber.—*The Natural Law of Relation between Rainfall and Vegetable Life and its Application to Australia.* By FRANZ A. VELSCHOW, C.E. Which develops the theory that deserts have a "cushion" of air over them which effectually buoys up rain-clouds, and prevents them from ever discharging their contents.—And the *Reports of Excursions during the Summer of* 1887 made by the London Geological Field Class under the direction of PROFESSOR H. G. SEELEY. (London: Geo. Philip & Son. 1888.) Short, thoroughly practical, and useful to the field geologist.

THE FACE OF THE SKY FOR JUNE.

By F.R.A.S.

THE student may continue to watch the sun for the small spots which appear at distant intervals. Midnight, on June 20, is the date of the summer solstice, and the 21st is the date of the "longest day." There is no real night this month in any part of Great Britain. Map vi. of "The Stars in their Seasons," shows the face of the night sky. Mercury, as an evening star, is capitally placed for the observer, and may be well seen without instrumental means, after sunset, over the N.W. by W. part of the horizon. Towards the end of the month he presents a pretty little crescent of over 11″ in diameter. On the 12th, when at his greatest elongation east of the sun, he will be a little more than 1° north of δ Geminorum ("The Stars in their Seasons," map ii.). Venus is a morning star, and is approaching the sun. She is but poorly placed indeed for the observer. Mars is approaching the west and should be looked for as soon after sunset as he is visible. His angular diameter continues to diminish, and it requires a pretty powerful telescope to detect much detail on his surface. He will be found in Virgo ("The Stars in their Seasons," map v.). Jupiter's position is improving a little: but he still has considerable (though decreasing) south declination. He should be observed when close to the meridian. He is in Libra ("The Stars in their Seasons," map vi.) throughout the month. The phenomena of Jupiter's satellites observable at convenient hours during June are as follow: Satellite i. will be occulted on the 1st at 10h. 52 P.M. On the 2nd, satellite i. will pass off Jupiter's disc at 10h. 12m. P.M.; followed by its shadow at 10h. 29m. P.M. On the 6th satellite ii. will disappear in occultation at 10h. 36m. P.M.; as will satellite i. 37 minutes after midnight on the 8th. On the 9th, the transit of satellite i. will begin at 9h. 44m. P.M.; as will that of its shadow at 10h. 11m. The satellite will leave Jupiter's opposite limb at 11h. 56m. P.M., and the shadow 23 minutes after midnight. On the 10th satellite i. will reappear from eclipse at 9h. 40m. 31s. P.M. On the 13th satellite ii. will be occulted at 12h. 53 P.M. The egress of this same satellite from the face of the planet will happen on the 15th at 10h. 18m. P.M., and it will be followed by its shadow at 11h. 29m. On the 16th the transit of satellite i. will begin at 11h. 30m., as will that of its shadow at 12h. 5m. P.M. Satellite i. will reappear from eclipse at 11h. 34m. 51s. P.M. on the 17th, as will satellite iii. from occultation at 10h. 25m. P.M. on the 18th, only to suffer eclipse later at 11h. 15m. 38s. On the 22nd the transit of satellite ii. will begin at 10h. 6m. P.M., and that of its shadow at 11h. 33m. The satellite will pass off Jupiter's face 35 minutes after midnight. On the 24th satellite i. will be occulted at 10h. 34m. P.M. On the 25th the egress of satellite i. from Jupiter's limb will happen at 9h. 55m., and that of its shadow at 10h. 42m. P.M. Finally, 4 minutes after midnight satellite iii will be occulted. Saturn has left us until the end of the year. Uranus is rapidly approaching the west, and to be seen at all must be looked for the moment it is dusk. He is situated between Spica and γ Virginis ("The Stars in their Seasons," map. v.). The moon enters her last quarter 53 4 minutes after noon on the 1st, is new at 4h. 34m. P.M. on the 9th, enters her first quarter at 6h. 49 7m. on the morning of the 17th, and is full at 9h. 7·5m. in the evening of the 23rd. The sole occultation of a star visible during June at a convenient hour is that of 50 Sagittarii on the 24th. The star, which is of the 6th magnitude, will disappear at the bright limb of the moon at 10h. 6m. P.M. at an angle of 65° from her vertex, and reappear at her dark limb at 11h. 16m. P.M. at an angle from her vertex of 250°. At noon to-day the moon is in Aquarius, which constellation she quits for Pisces at 9h. A.M. on the 2nd ("The Seasons Pictured," plate xxii.). In her journey through Pisces she passes into Cetus at 3h. A.M. on the 3rd. At 1 P.M. on the 4th she emerges from Cetus and re-enters Pisces, which she quits for the second time for an outlier of Cetus at 10h. A.M. on the 5th. When she finally leaves this constellation at 8h. A.M. on the 6th, it is to come out in Aries ("The Seasons Pictured," plate xxii.). Her passage over Aries is completed by 7h. 30m. A.M. on the 7th, at which hour she crosses the boundary into Taurus. She is journeying across Taurus until 7h. A.M. on the 10th, and then reaches the most northerly part of the northern prolongation of Orion. By 5 o'clock that same afternoon she has crossed this and come out in Gemini ("The Seasons Pictured," plate xxiv.). Here she remains until 4h. P.M. on the 12th, when she enters Cancer. She is travelling through Cancer until 6h. 30m. A.M. on the 14th. She then passes into Leo, there she continues until 10h. P.M. on the 16th, crossing the boundary at that hour into Virgo ("The Seasons Pictured," plate xxv.). She is travelling through that great constellation until 11 P.M. on the 19th, when she leaves it for Libra. As she journeys across Libra she arrives at 1h. P.M. on the 21st, at the western edge of the narrow northern spike of Scorpio ("The Seasons Pictured," plate xxvi.). By 1 o'clock next morning she has crossed this and come out in Ophiuchus. Hence she passes into Sagittarius at 1h. P.M. on the 23rd. At 5h. P.M. on the 25th she has traversed Sagittarius, and is entering Capricornus. She leaves Capricornus for Aquarius at 2h. P.M. on the 27th ("The Seasons Pictured," plate xxi.), and Aquarius in turn for Pisces at 5h P.M. on the 29th ("The Seasons Pictured," plate xxii.). As at the beginning of the month, she arrives in the confines of Cetus at 10 A.M. on the 30th, and is still in Cetus when these notes terminate.

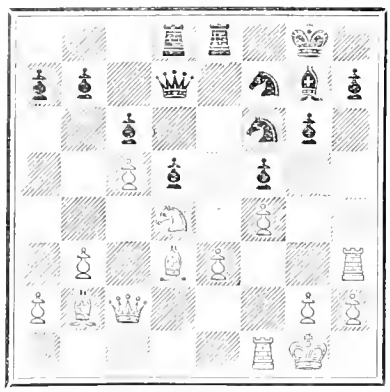
THE name of Dollond (optician) has been associated with St. Paul's Churchyard for the past 135 years, and until just lately had no other place of business in London. It will be interesting to City men to know that Dollond & Co. have now opened a branch establishment nearly opposite the City of London Club in Old Broad Street, over which one of the partners of the firm presides.

Our Chess Column.

BY "MEPHISTO."

THE following position occurred in the deciding game of the match between Mr. Burn and the Rev. J. Owen for the Rutherford Challenge Cup:—

A. BURN.
BLACK.



WHITE.
J. OWEN.

It was White's turn to play, and the game continued:—

WHITE.	BLACK.
1. Kt × KBP (*a*)	1. P × Kt
2. B × P	2. Q to B2 (*b*)
3. B × P (ch)	3. K to Bsq
4. Q to B5	4. Kt to R4 (*c*)
5. B to K5 (*d*)	5. B × B
6. P × B	6. Kt to Kt2 (*e*)
7. Q to B4	7. R to Q2
8. B to Kt6	8. K to Ktsq (*f*)
9. Q to KR4	9. Q × P (*g*)
10. B × Kt (ch)	10. K to Bsq
11. B × R (dis. ch)	11. K × B
12. Q to R8 (ch)	12. K to K2
13. Q to B8 (ch)	13. K to K3
14. R to R6(ch)	14. Resigns.

(*a*) Fine play! If Black refuses to take the Kt, White by playing Kt to R1 evidently gets a strong attack with a pawn ahead.

(*b*) The alternative move is 2. Q to K2.

(*c*) If 4. Kt to Q2, then 5. B to Kt6. If 4. Kt to Ktsq, 5. B × B (ch), and 6. Q to Kt6 (ch), &c., 4. Kt to K5 was probably best.

(*d*) A good move, which forces the opening of the KB file for the rook

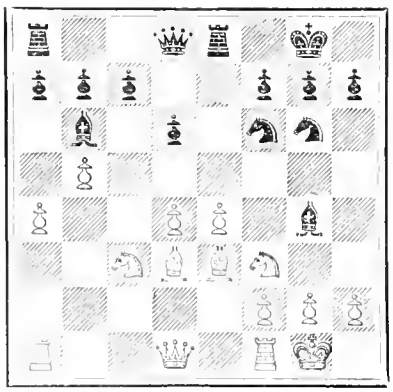
(*e*) If 6. R × P. 7. Q to Kt4; Kt to Kt2. 8. B to Kt6 winning.

(*f*) To guard against the mate by 9. R to R8 (ch).

(*g*) Black cannot save the game, and now the mate is forced in six moves. The ending is a remarkable example of the way an apparently sound and strong position may be shattered.

Position between the same players arising from an Evans declined:—

A. BURN.
BLACK.



WHITE.
J. OWEN.

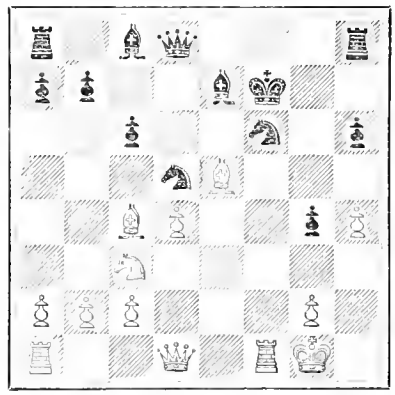
The game terminated as follows:—

	13. B to QR4
14. Kt to K2	14. Kt × P
15. B × Kt	15. R × B
16. Kt to Kt3	16. R to Ksq
17. P to KR3	17. B to Q2
18. Kt to Kt5	18. R × B
19. Q to R5	19. R to Ksq
20. Q × P (ch)	20. K to Bsq
21. Kt to R5	21. Q × Kt
22. P to KB4	22. Q to R3
Resigns.	

The following very interesting variation, which arises from the Hampe-Algaier-Thorold Opening, is brought about in a natural way, and its frequent occurrence in practical play being very probable, the useful knowledge may be applied as the pleasurable occasion arises:—

WHITE.	BLACK.
1. P to K4	1. P to K4
2. QKt to B3	2. QKt to B3
3. P to B4	3. P × P
4. Kt to B3	4. P to KKt4
5. P to KR4	5. P to Kt5
6. Kt to KKt5	6. P to KR3
7. Kt × P	7. K × Kt
8. P to Q4	8. P to Q4
9. P × P	9. QKt to K2
10. B × P	10. Kt × P
11. B to B4	11. P to B3
12. B to K5	12. Kt to B3
13. Castles KR	13. B to K2

BLACK (thirteen pieces).



WHITE (thirteen pieces).

In this position White has the choice of two moves. The first by which he can recover his piece, leads to the following play:—14. B × Kt; B × B. 15. Kt to K4; K to Kt2. 16. B × Kt; R to Bsq. 17. Kt × B; R × Kt. 18. R × R; Q × R. 19. B to B4, or Kt3, &c. But the other move is 14. Kt to K4, which brings about very pretty play, and gains a winning advantage, *i.e.*—

14. Kt to K4	14. K to Ksq

If the King does not move, then of course B × QKt, followed by Kt × Kt, with a winning attack.

15. B × QKt	15. Kt × B
16. B × R	16. Kt to K6
17. Q to K2	17. Kt × R
18. Kt to B6 (ch)	18. K to B2
19. R × Kt	19. Q × B
20. Kt to Q5 (disc ch)	

with a winning attack. The only remaining feasible move for Black is K to Kt3, and this brings about some very pretty play as follows:—

14. Kt to K4	14. K to Kt3
15. Q to Q3	15. Kt to Kt5

This is the only move to prevent an early mate by a discovered check, but White can now win in the following pretty manner:—

16. Kt × Kt (disc ch)	16. Kt × Q
17. P to R5 (ch)	17. K to Kt2

If K to Kt4, then White mates in three by Kt to K4 (ch).

18. Kt to K8 (ch)	18. K to R2
19. R to B7 (ch)	19. K to Ktsq
20. QR to KBsq	

and Black cannot avoid the mate in a few moves.

Our Whist Column.

By "FIVE OF CLUBS."

DECISIVE PLAY.

THE following case, which occurred at play a few evenings since, shows the advantage of prompt decision at whist, and how considerations of whist strategy sometimes render it desirable to run dead counter to accepted canons.

I was the dealer (Z), and turned up the heart ace; in my hand I found two small trumps, diamond ace, queen, ten, and two little ones; spade king, queen, and a little one; club ace and a little one.

The score was—A-B, three; Y-Z, two.

A led a trump, Y played a small one, B put on the knave. The heart ace was the natural card to play under the circumstances. Half a dozen rule-reasons could be cited. A, having led trumps, wanted trumps returned, and, playing the ace, would stop that for the moment. If trumps were returned, B would be leading through Z's honour. Trump strength being with the enemy, it was desirable, according to the usual rule, to show the enemy as little as possible about the position of the remaining trumps. And so forth, and so forth.

But I played a small trump, feeling—against all cut-and-dried rules—that my double tenace in diamonds, with re-ent-ring cards in spades and clubs, made that play at least safe, while there was a fair chance of scoring freely. Moreover, A having led trumps, it was quite likely that A-B held between them two by honours, in which case nothing but forward play could save us as the score stood.

B returned trumps: I passed, A taking the trick, and third round falling to my ace: my partner discarded a diamond. (I knew this to be his shortest suit, because I could depend on his recognising my play as emphatically indicating all-round strength; so that the cut-and-dried rule to discard from the longest suit in presence of the enemy's trump lead would not influence him as against the obvious requirements of strategy.) Two by honours were now declared against us, and the chance of defeat seemed heavy. Yet my play would probably save us a point, even if we were defeated. I led my fourth best diamond—not, as rule would require, the ace; for on the line I was following everything depended on keeping re-entering cards to the last. Y took the trick with the knave, and returned a small one. As nine had fallen from A, I knew that his king must fall this round to my ace; otherwise I should have been tempted to play the queen in order to make sure of the entire command of the suit—for a king left in A's hand after my ace was played would have stopped my long suit effectually. (This, however, would have been giving up all chance of game for the certainty of saving only a point.) I next led the queen, which A of course trumped. All the diamonds outside my hand fell to this round. A led a small spade, and the trick fell to my queen—on B's ten. My diamond ten drew A's last trump. A led another small spade. My partner, who held the ace, nine, and two little ones, played a small one, knowing the king must be with me. I made my long diamond—the deuce—and my club ace, then led a spade, knowing my partner must hold the ace and probably the nine. His major tenace in A's suit being thus led up to, he made the remaining tricks.

Thus A-B made only four tricks, though A held king, queen, ten, nine, eight of trumps, knave and three small spades, king and queen of clubs, and guarded king of diamonds; while B held knave and two small trumps, and knave, ten, nine of clubs. A-B did not make a single trick in their plain suits, though holding two kings, two queens, two knaves, two tens, and two nines—out of three.

Y-Z scored four and the game—which, as it chanced, decided a rubber.

DOUBTFUL LEAD.

The able whist editor discusses the question of the right original lead from—ace and two trumps (hearts); ace, queen, ten, and two small clubs; king and three small diamonds; and spade queen. [I quote from memory, having mislaid the cutting: but the hand is right, though the suits may be wrong.] He considers that, although the lead of the club ace would be usual and not to be blamed, the lead of spade queen, as giving on the whole fullest information to partner, would be more effective. I cannot agree with him. It seems to me the immediate declaration of weakness in spades would be apt to have a most damaging effect. For my own part—but I am rather a venturesome trump-leader—I should be apt, unless playing for the odd trick, to take out two rounds of trumps. But I believe the best lead would be the penultimate (original fourth best) club. Partner, on recognising that, though holding ace to five, the original leader had not led it, would see that he was holding it as a card of re-entry, and would lead trumps if strong enough to back up the leader's manifest strategy: king of diamonds and even queen of spades would be possible cards of re-entry.

SCIENCE IN WHIST.—AN ANGRY LETTER.

Mr. Francis Ram writes me a very angry (I might almost say an abusive) letter, asking if I imagine the readers of these columns will not recognise the unfairness with which he has been treated. He in effect asserts that I quoted his first letter in full only because I expected to get an easy victory over him, and left his last unquoted because I found I was getting the worst of the discussion.

I have to apologise to the readers of these columns for quoting at all—in a magazine called KNOWLEDGE—from a letter written on a subject about which our correspondent professedly has at present no knowledge. But it so chanced that the letter reached me just as I was putting the finishing touches to an article on the science of whist, and seemed so singularly apropos that I put it at the head of my article, and by sundry touches made the article read like a commentary on the text supplied me by Mr. Ram (KNOWLEDGE for December 1887). I inserted (KNOWLEDGE for January 1888) Mr. Ram's reply, which was, however, in fact no reply at all, as he simply dwelt on the fact that chance plays a more important part in whist than in chess, which every one knows—the real fact being, however, that it is through the part chance plays in whist that the game derives its most essentially scientific characteristic.

The matter may be presented in abstract thus:—

Mr. Ram, carefully showing that he knows nothing of science in whist, denies its existence, and asserts that success comes as freely to the bumble-puppist as to the man who fancies he is playing a scientific game. I endeavour to make it clear to him and others that (passing over his mistake in writing, too, without knowledge to KNOWLEDGE) (1) there is science in whist; (2) science tells, as statistics show; and (3) the scientific game is a game worth playing, whereas the pure chance game of playing out winning cards and leaving the adversary to make theirs is not worth the trouble of sitting down to. (Have I not played it? And do I not know its utter dreariness? I have also in childhood's hours played "Beggar my Neighbour," and I know not which game is the slowest.) Mr. Ram reiterates his opinion that "play in whist is necessarily a mere muddling along," and asks how often in chess bad play will succeed against good play—comparing a subject of study with a recreation.

Mr. Ram's failure to understand how the very chances in the game of whist add to its scientific character would show, if the fact had not been already clearly indicated, that he has not yet entered the charmed and charming circle about the mysteries within which he nevertheless insists on speculating.

Let me illustrate the matter by two examples—one telling of a successful achievement of mine, in which chance played a part; the other of a bad mistake, for which I was deservedly punished:—

1. The first case is the game described above. Here I adopted in the first round a course which would certainly never have suggested itself to a bumble-puppist, and I was guided thereto solely by a consideration of the chances. I held an honour myself, and an honour had fallen on my right; the leader had either led (in all probability) from five trumps or from four trumps two honours. In the latter case the enemy would certainly go out in honours unless we could make three by cards, and would count a double unless we could make the odd trick. In the former case the leader still held four trumps out of the nine whose position remained unknown, and it was therefore more likely than not that of these nine cards the two honours were in the hands of the enemy. As I had myself great strength in plain suits, it was rather more likely than not that A's lead was rather from great trump strength than from combined strength in trumps and plain suits. For this reason I passed the first trick, thereby showing my partner (a keen player) that he must play as knowing I held great strength in plain suits, for nothing else would explain my holding back the ace, which was the trump card. The rest of the play, as above described, depended throughout on the line I had thus adopted. (My partner would have discarded a spade to the third round of trumps but for my declaration of strength—and a single spade thrown from his hand would have meant the loss of the game to us.)

2. The second case is one I am somewhat ashamed of; but readers of these columns are entitled to the lesson it teaches. I had got out all the trumps, including my own, and remained with

king, queen, and a small heart, and a king-card in clubs. (I had already made my long spades, and we were now playing out the fag end of the hand; hearts had not yet been led, though three hearts had been played.) I knew perfectly well that the chances were in favour of the correct lead—heart king, and that nothing in the lateness of the suit affected the propriety of the lead. We had made the odd trick already, and if my partner held the ace, we should make all four tricks and go out; but if the enemy held it, we might make three tricks, two, or one out of the remaining four. Leading king ensured two; and though leading a small card gave a chance of three, the chance of three was not equal to the certainty of two, which was thrown away by leading the king. As we wanted four tricks to save the game—for the enemy had shown two by honours, and were at the score of three—making three more tricks which would have brought our score to "four," and made the game a "single" to the enemy, was not worth more than making two. Despite all this, which should have been obvious, I played the small heart, for the chance of making three of the remaining tricks. Ace lay on my left, however, and the trick fell to heart ten on my right. Club was led, and my king-card made. I had then to lead heart king, which fell to the ace, and the deuce of clubs being led took the last trick. The enemy scored a "double" and the rub.

Of course this was sheer bad play on the part of one who knew the right course. It was due to inattention to the score first, and secondly to misjudgment of the chances. But the bumble puppist, placed in my position, would play the small heart every time. The only difference would be that he would play the king card in clubs first, thereby making the chances worst, for want of a re-entering card to bring in the king and queen, which he had been nursing so carefully.

That scientific whist-players are at issue on some minor points (the more serious differences in regard to the signals have no relation to the science of the game, only to its qualities as a recreation) proves only that some of the problems involved in the game are very difficult. Considering that the possible hands are to be numbered by hundreds of thousands, it is not to be wondered at that in some cases there is great difficulty in deciding what is the proper course. Let any one consider, for instance, all that is involved in the problem whether second player holding king and two others should put the king or queen led. Not only are there all the chances to be considered in regard to the making of tricks in the first two rounds of the suit, but the question whether it is more important to make sure of as much on these rounds as can be made, or to hold the command till the third round, and so prevent leader from making long cards in the suit. This again depends on a number of considerations—as on the possession of command in other suits, on the probabilities as to partner having such command, &c. &c. For my own part, considering this particular point only, I wonder less that there should be difference of opinion than that any player who knows the game should undertake to lay down a definite rule at all, where the primary chances are so equally balanced that very slight differences in the circumstances may make one course the better or the other.

MATHEWS ON WHIST.

THE FINESSE.

In playing for the odd trick few finesses are justifiable. This is a nice part of the game, and experience, with attention, will alone teach it with effect.

Finessing in general is only meant against one card. There are, however, situations when much deeper finessing is required; but theory alone can never enable the beginner to learn these. As an illustration, suppose it is necessary you should make two out of the last three cards in a suit not yet played, and you hold ace, ten, and a small one; if your partner leads the nine, how should you play? The proper course is to pass it, even though in so doing you are finessing against three cards, for if your partner has an honour in the suit you make two tricks, and if not you cannot make two tricks by any mode of play whatever.

As the following, or nearly similar, situations frequently occur, I recommend them to the attentive study of those players who, feeling within themselves that they comprehend what may be called the alphabet of whist, desire to procure a gradual insight into the game, all the combinations of which, I cannot too often repeat, proceed from very plain and simple principles. It requires some reflection, however, to recognise the truth of the same maxim, when applied to inferior cards, which appears self-evident in the case of higher cards. Thus there is scarcely a player who, if he has the ace, king, knave of a suit of which his right-hand adversary has turned up the queen, but will lead the king and wait for the return of the suit to win with his knave. [Mathews says to finesse his knave, but there is no finesse.] But with ace, queen, and ten—the knave being turned up on his right hand—the same player will often fail to see that his lead, if he plays a trump, is the queen, and that one and the same principle actuates the play in both cases: and so through the suit.

Should your left-hand adversary lead the king from ace, king, knave, to have the finesse of the knave, and it comes to your lead, it is evident the finesse will succeed, if you remain with the queen and one more. In this case play the small one through him, as this frequently prevents him from making the finesse, though he originally played for it.

If left with the last trumps and some winning cards, with one losing one, play the losing card first, as your adversary on the left may finesse; and if the second best is in your partner's hand it may make the trick—which cannot be made if you leave the trick to the last.

Finesses are generally right in trumps, or in a plain suit if you are strong in trumps; otherwise you should be cautious in finessing.

NOTE.—In our next we shall complete our rearrangement of "Mathews on Whist." There remain at present but a few paragraphs on playing to the score, some considerations relating to end play (a few examples), and some paragraphs relating to "the call," and other points belonging to long whist. I must confess that in going through Mathews (which has been a rather laborious task, owing to the entire absence of order in his work, and his confused style of writing) I have been strongly impressed with the close correspondence between good whist in his day and good whist in our time. There have been considerable changes in matters conventional, but the changes in regard to strategy have been very slight indeed. Some of the suggested changes seem to me far from being improvements, especially the discard from the best suit in presence of the enemy's trump lead, instead of the old rule to discard in that case where you can spare a card best or with least risk—that is, generally, from a well-protected suit (though where you have perfectly useless cards in a suit, one of those should be thrown away rather than diminish your protection, even in a well-protected suit).*

DESTRUCTION WROUGHT BY INSECTS IN AMERICA.—The annual loss to productive industries in the United States caused by insects is estimated at 150,000,000 dollars. Here is a fair battle between man and another sort of earth occupiers. They are smaller, but if they can whip us have undoubtedly as good a right to the world as we have. As civilisation advances new insects make their appearance, marching sometimes eastward, but generally westward. There are few, if any, forms of vegetation that have no parasites that devour either foliage or fruit. The loss to the cotton crop is estimated at 15,000,000 dollars a year, while that to the apple crop is not much less, and that to the potato crop at least one-half as much. But the estimate is not a fair one until into the loss is counted the time spent in fighting to secure the proportion that is saved.

CONTENTS OF No. 31.

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* The idea of the modern conventionalist is, of course, to have a means of showing partner the best suit (in this case) by the discard; it does not at all trouble him that (1) you may be quite as likely to want to show him that you have no suit worth leading to; and (2) when the enemy show strength the time is better suited for lying low than for showing your partner what you hold. The lead is more than twice as likely to come from the enemy as from him.

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MAN'S RELIGION THE EXPRESSION OF HIS KNOWLEDGE.

SOME time since a series of papers appeared in KNOWLEDGE under the title "The Unknowable," in which we attempted to show how that borderland beyond the known (or what is supposed to be known) in which lie all the vague possibilities man is ever ready to picture where ignorance or imperfect knowledge permits, is the true domain of religious aspirations in so far as they belong to emotional faith. We now propose to supplement those papers by a series showing in what sense religion is the outcome of knowledge, and how the religion of every nation and of every age has ever been the expression of the knowledge (such as it has been) of each nation and each age. We shall, in fact, strive to do for religion from one special point of view what Professor Drummond has striven to do for it from another. He has endeavoured to show that in the spiritual world there are natural laws akin to those which the student of science has learned to recognise in the world of matter. We shall endeavour to show that the men of every age and nation have striven to embody in their religion such natural laws as they knew or supposed they knew. In other words, we shall strive to show the eminently reasonable character of all religious systems, nay, of each specific religious dogma—granted only that men had rightly apprehended the significance of the facts of nature as seen by them and as they understood them. We may thus learn how it has come to pass that certain doctrines have been almost universally accepted; others limited to special races or to special times. We shall learn to distinguish what is probably well founded from what is probably unsound in the religions of the human race—not by considering religious doctrines in themselves, but by striving to understand on what ideas about natural facts or natural laws they were originally based. And in this way the true bearing of science on religion will be recognised. For few scientific teachings have any direct bearing on religious doctrines as actually developed, even when they may have the most decided and decisive bearing on the ideas out of which the development of that doctrine sprang. As the discoveries of astronomy have no direct bearing on the doctrines of astrology, while fully interpreting most of the facts on which those doctrines were originally based, so is it with the teachings of modern science in relation to nearly all the doctrines of every religion the world has known. Science can seldom prove or disprove any dogma of religion, but science can in a number of instances say confidently that this or that fact on which such and such dogmas were primarily based must be interpreted thus or thus—as it was interpreted by those who first found in it the germ of some special religious teaching, or (it may be) *quite otherwise*.

In such an inquiry science is working, without doubt, within its proper field. For it is the special aim and purpose of science to interpret facts if it can, and to classify them (for future interpretation, perhaps) where it cannot. The student of religion will also here be engaged on an inquiry which really bears upon religion: for he cannot but be interested in considering the origin of specific religious doctrines; and where observed facts or supposed facts and natural laws more or less clearly discerned have led (as they always have led, first or last) to religious views, it cannot but interest him to inquire how far the observations were real or illusory, and in what degree laws really hold which men have supposed they had determined. The inquiry will extend to each one of those dogmas of religion to which Professor Drummond has striven to extend the idea of natural law, but other matters (outside his subject) will be considered also in our discussion of religious views as the expression of men's knowledge, real or supposed, of nature and her workings.

THE RELIGION OF THE ANCIENT BRITONS.*

II.

IT is among the non-Aryan, pre-Celtic dwellers in Britain that Druidism flourished, and became in large measure mingled with Celtic polytheism, so that the elements of each are not easy of separation. Cæsar says of it that it "is thought to have been invented in Britain, and to have been carried over to Gaul; and at the present time those who wish to gain a more precise knowledge of the system travel to that country for the purpose of studying it."† The straightforward and interesting account which he gives of Gallic Druidism, of the functions of the priesthood and character of the ceremonies, is therefore to be applied, with local modifications, to Britain. But we must guard against giving high-sounding names and titles, and crediting philosophic qualities, to a religion so barbaric in its origin and essence as that of the earlier races of these islands, judging from analogy and from the description of Tacitus and other writers, must have been. A good deal of speculation has been expended on the derivation of the name Druid, the Irish word for which is *draoi*, meaning a magician or soothsayer; but Professor Rhys, after weighing the matter, and citing evidence concerning tree-worship, inclines to the old etymology *drus*, "oak," as the true one. Not only was that tree, as the emblem of Jupiter, sacred among the Romans, who also called the acorns "juglans," *i.e.* "Jovis glans," the fruit of the god; among the Greeks, in whose literature and legends there is frequent reference to the oak as sacred to Zeus, who, as the source of divination, spake through the rustling leaves of the sacred oaks at Dodona; among the Scandinavians, as the tree of Thor; and among the Teutons, as shown in the many vestiges of holy oaks; but also among the non-Aryan Finns, as sacred to Jumala, their supreme god.

Stripped of the philosophic garb in which contact with more civilised races, or with which the imagination of classic writers endowed them, and as yet unmodified by the milder influence of Aryan polytheism, the Druids were doubtless the magicians, soothsayers, and priests—"the swarm of prophesying quacks" as Pliny calls them, corre-

* "Lectures on the Origin and Growth of Religion, as illustrated by Celtic Heathendom." By John Rhys, Professor of Celtic in the University of Oxford. (Williams & Norgate: 1888.)

† "De Bell. Gall." vi. c. 12.

sponding in their assumptions and pretensions to the medicine-men of all barbarous peoples. Shamans, conjurors, sorcerers, wizards, spiritual ancestors of all those who claim to hold the keys of the kingdom of heaven, to bring down gifts for men, to bind or to loose, to absolve or to curse, such men naturally rose to power among, and to rule over, their fellows, whose terrified and undisciplined imagination saw in them the ministers and agents of the gods. "They tamed the people as wild beasts are tamed," and among the convenient weapons which they used in common with wizards the world over, were fetichism, magic, and divination in many forms, notably by the entrails of sacrificed victims and the flight of birds. The old account of their ceremonies in groves, of their cutting with golden sickle the mistletoe when, growing from the sacred oak, it denoted the presence of the god, and of their bearing it on waggons drawn by two snow-white bulls, point to a form of nature-worship which had been assimilated and refined by Celtic polytheism. But we know Druidism only as thus amalgamated, and we need to resolve it into more primitive and grosser elements. One of these is, without doubt, that ghastly rite of human sacrifice which does not, as has been suggested, indicate Semitic influences, but which has its origin in the primitive object and intent of offering to the gods that which, being most valued by man, must be most acceptable to them. If any person of importance were in peril from disease or from the chance of war, a criminal or slave was killed, or promised as a substitute. The Druids held that by no other means could a man's life be redeemed or the wrath of the gods appeased; and they went so far as to teach that the crops would be fertile in proportion to the richness of the harvest of death. It became a national institution to offer a ghastly hecatomb at particular seasons of the year. In some places the victims were crucified, or shot to death with arrows; elsewhere they would be stuffed into huge figures of wickerwork, or a heap of hay would be laid out in the human shape, where men, cattle, and wild beasts were burned in a general holocaust. The memory of the public sacrifices seems to have been preserved by the Irish proverb, in which a person in great danger was said to be "between two Beltain fires." In the Highlands, even in modern times, there were May-day bonfires at which the spirits were implored to make the year productive, a feast was set out upon the grass, and lots were drawn for the semblance of a human sacrifice, and whoever drew the "black piece" of a cake dressed on the fire, was made to leap three times through the flame. In many parts of France the sheriffs or the mayor of a town burned baskets filled with wolves, foxes, and cats in the bonfires at the Feast of St. John; and it is said that the Basques burn vipers in wicker panniers at midsummer, and that Breton villagers will sacrifice a snake when they burn the sacred boat to the goddess who has assumed the title of St. Anne.

The Welsh and Irish traditions contain many other traces of the custom of human sacrifice. Some of the penalties of the ancient laws seem to have originated in an age when the criminal was offered to the gods. The thief and the seducer of women were burned on a pile of logs or cast into a fiery furnace: the maiden who forgot her duty was burned, or drowned, or sent adrift to sea. The lives of the saints and the household fairy tales are full of the miracles by which the innocent queen or princess is saved from an unjust doom.

All these are of the past, yet now and again reminders come to us what strange beliefs are yet nurtured among us, what fetichistic customs still linger, what unlaid ghosts still haunt the barrows, what fairy-darts and elf-bolts are still thrown, what merry dances the little people still have in their fairy rings, what helpful or spiteful things they do, in districts where the thud of the navvy's pickaxe has not disturbed their trysting time, nor the screech of the railway whistle driven them to their underground homes, where, according to Danish legend, their ancestors, the unwashed children of Eve, were cast by Jesus.

The older and grosser elements, never eliminated from Christianity, easily coalesced with those in the pagan religions, which it nowhere thoroughly supplanted. It had attained a richer spiritual development than they, but its roots lie in the same soil, fed by the same needs. The penalties pronounced in its authoritative writings against witches; the vast organised doctrine of demonology which was, and is, an integral part of the teaching of its founder, and therefore of his disciples; the superstitions attached and attaching to the water of baptism, and which led the ignorant rustic to steal it from the fonts for use in magical rites (accounting for locked covers on fonts); these and other elements, of the earth earthy, it shared with other religions, and if it bestowed upon them new names, the essence remained unchanged.

The dressing of wells at Tissington and other places; the wells in the northern counties into which the country girls throw pence as offerings to the spirits; the rags and other votive offerings on trees and hedges around sacred wells in Britain and Ireland; the pilgrimages to St. Gowen's well in Pembrokeshire: are among the undoubted relics of that water-worship which is one of the many departments of the nature-worship of our forefathers, and which is linked with the offerings round sacred wells in India and Ceylon, and with the more graceful Fontinalia of the Romans, when the fountains and wells were garlanded in honour of their nymphs.

One might think that there remained no relic of sacrificial customs which, as we have seen, were so hideous a feature of the old British religion, as of all others at a correspondingly low level; and yet it is recorded that not twenty-five years ago, when a herd of cattle was attacked with murrain, one of them was buried alive as a propitiatory offering for the rest, and that a live ox was burned in Northumberland with the same intent; whilst a remedy for erysipelas applied within recent years was to cut off part of a cat's ear and let the blood drop on the part affected. So in the Highlands and Cornwall, a black cock is buried alive on the spot where a person is first attacked by epilepsy.

Scratch a Russian, says the adage, and you will find a Tatar; scratch a peasant, and, for the matter of that, a good many of his betters, and you'll find a fetichist—a pagan to the core. What will the old crones tell us to this day? That the sickly child will not thrive till it is christened; that the souls of the unbaptised babes wander in the air till Doomsday, or join the mystic team of the Wild Huntsman, be he Arthur or Odin; that the first parings of the infant's nails, which must never be cut on a Friday, should be buried under an ash-tree, in which superstition we see mixed the savage notion of burying nail-parings and other refuse lest the sorcerer work harm thereby, and the important part assigned to the ash in Norse, American, Greek, and other myths; that the mourner on whom the sun shines at a funeral is sure to die; that when birds tap against the window, or ravens croak, or the dogs howl before the house, or the click of the death-watch spider is heard, or, querest of all, when one's own wraith is met, or a corpse doesn't stiffen, 'tis an omen of death.

Furthermore, that the faithless lover's heart may be tortured by sticking pins into a hare's heart; that 'tis unlucky to look at the new moon through glass; that 'tis wicked to point at the stars or count them—itself a relic of the Aryan ancestor-worship, and of the personifying of the "Fathers" who live in the sky along with Yama, and who are the great original

Pitri of mankind; that one should always invoke a blessing on a sneeze, itself a relic of the well-nigh universal barbaric belief that the sneeze indicates the expulsion of a demon, whose return the invocation prevents; that whooping-cough can be cured by passing the sufferer under a donkey's belly, or by popping a trout's head in its mouth, or putting a hair of the patient's head between two slices of bread-and-butter and giving it to a dog: that toothache can be cured by a charm written in a Bible, as in Africa the sick native drinks the water in which a board with written characters on it has been washed; that rheumatism can be cured by confirmation, or cramp prevented by placing one's shoes toe to heel; that the hair of a dog will cure a dog's bite, a very widespread superstition, from China to Iceland, for the Edda commends it; that the pining away of a child is due to the evil eye; that the idiot child is a fairy's changeling, of the existence of which Dr. Martin Luther was as firmly convinced as was John Wesley of the existence of witches. "Eight years ago," said the famous doctor, "there was a changeling in Dessau, which I, Dr. Martin Luther, have both seen and touched . . . and which I would have had thrown into the water at the risk of being a homicide. But the Elector of Saxony wouldn't follow my advice. I then said they ought to cause a paternoster to be said in the church, that God would take the devil away from them. This was done daily, and the said changeling died two years after."

Such superstitions as are illustrated by the foregoing examples, which could be multiplied indefinitely, are explicable only on the ground that they are survivals of a barbaric past, which have remained persistent throughout the lower culture in these islands from prehistoric times. They have, with differences of detail incident to local characteristics, their parallels in all barbaric thought, and are the product of an age when the races dwelling in Europe were in the animistic stage of belief. That these superstitions remain among us despite the good Providence which has left no parish without a parson and a squire, only shows how the apathy and impotence of these time-honoured institutions have been conserving forces to which the Church, in incorporating into itself what it found too deeply-seated to destroy, and with which it had, without knowing it, much in common, has added her influence and sanction. The main conclusion to which the evidence leads is that the history of races and of their religions in Britain is continuous from the earliest Neolithic times to this day; that the non-Aryan—Iberian, Euskarian, or by whatever name we call them—are not extinct; and that the great body of superstitious beliefs and customs extant witness to stages of spiritual development among the peoples of these islands corresponding exactly to those of every other people who have emerged from fetichisms to those higher animistic conceptions which yet form the backbone of current theologies from "China to Peru."

In our desire to give prominence to the facts which warrant that conclusion, we have left ourselves no space to enlarge upon the copious and valuable analyses of the Welsh and Irish heroic legends, in which Professor Rhys discovers traces of Celtic deities, both major and minor, and of Celtic mythology. The process of transmutation, sometimes involving the degradation which the gods of an older faith undergo, has ample illustration here, and it is in the identification of the ancient divinities with the kings and heroes of romantic legends common to both Wales and Ireland that the ingenious and cautious scholarship of Professor Rhys is especially manifest.

While not committing himself to that wholesale rejection of the philological method of interpreting myths, Professor Rhys honestly admits that his views and methods have undergone material change, and he further wins our confidence by his recantation of that "Aryan heresy" of which Professor Max Müller seems likely soon to find himself the sole defender, and by his frank acceptance of the method which compares savage myths and rites with the traces of like absurdities and practices imbedded in the literatures and theologies of civilised races. In the concluding lecture, after justifying the dethronement of Sanskrit from its over-exaggerated place as the special representative of the Aryan parent-speech, and expressing his agreement with the revived theory of the Northern European origin of the Aryans,* he concludes his learned book with the following summary of what he regards as the earliest creed of the Celts:—

In the beginning Earth and Heaven were great world-giants, and they were the parents of a numerous offspring; but the Heaven in those days lay upon the Earth, and their children, crowded between them, were unhappy and without light, as was also their mother. So she and they took counsel together against Heaven, and one of his sons, who was bolder than the others, undertook shamefully to mutilate Heaven—nay, he and his brothers stayed not their hands till they had cut the world-giant, their father, into many pieces.† Out of his skull they made the firmament, and the spilling of the blood of his body caused a great flood, which, as it settled in the hollows of the earth, made up the sea.‡

Some of the children of Earth and Heaven were born bright beings or gods, who mostly loved the light and the upper air; and some were giants or Titans, who were of a darker and gloomier hue. These latter hated the gods, and the gods hated them. The daring son of earth who began the mutilation of the world-giant was one of the Titans, and he became their king; but the gods did not wish him to rule over them and their abode, so he was driven from his throne by his youngest son, who was born a god. The king, beaten in battle, sailed away to other parts of his realm: and after much wandering on the sea, he was at last received in the country of the happy departed, whence he was afterwards thought to bless the farmer's toil and to help man in other ways.

When the great flood caused by the mangling of the world-giant took place, all men were drowned save a single pair saved in a ship. He who made and owned the ship was not a man, nor did the gods own him as one of them, but he was a giant or Titan who was kindly disposed towards the race; and when he had safely landed them where they were to dwell, he went away to the same place as the dethroned king. For he was of his kith and kin, unless perhaps those are to be followed who thought the two were but one and the same person, and that person no other than the ruler of the departed himself, the god of all beginning and all end. Viewed through the medium of the latter, he appeared to be the demon of darkness and horror and death, ever busily adding to the number of his victims; but through the former he was seen to be the first father and great parent of all, so it was ever a matter of piety to reckon darkness before light, the night before the day, and winter before summer.

The new king of the gods was of a passing brilliant nature, so they called him Bright and Day and Father Sky. He was a mighty warrior, but he had terrible foes, who forced him to take part in many a fearful struggle. When he fought in summer he always triumphed, but he fared ill in the winter conflicts. On one occasion he was badly wounded, and would never have recovered his former strength and form but for the timely aid of a man who was a cunning leech, and on another he and the other gods would have been hard beset had they not taken care to secure the help of the Sun-hero. This last was not a god, but the youthful son of a mortal. There was, however, no spearman anywhere to equal him, and his father was so wise and crafty that he had forced the gods to treat mankind far better than they had before been wont to do. For the good things bestowed on man were often begrudged by the gods, and most of all by the owners of the wealth of the nether world and the land of the happy dead. They hated this mortal, so kind to his race, and made him suffer untold pain and torture, but he always succeeded in the end in all that he set his mind on achieving, as when, for example, he cheated them of the dog that was to be the hunter's friend and servant; also of the other animals he stole from

* Cf. Professor Rhys's excellent discussion of this question in his article on "Race Theories and European Politics" in the *New Princeton Review*, January 1888.

† Vid. KNOWLEDGE, April 1888, p. 136.

‡ Cf. Grimm, "T. Mythol.," 559; and Vigfusson and Powell's "Corpus Poet. Boreale," i. 61.

them as likely to be of use to his kindred. It was from the same nether country that he likewise obtained by craft and falsehood the strong drink that was to cheer man, to give him the dreams of poets and the visions of prophets. These and other boons, too many to name one by one, made him very famous and beloved, more so in some lands than even the king of the gods himself.

ENGLISH PRONUNCIATION.

T first sight it seems strange that the pronunciation of English, though diverse both in America and in England, is more diverse in the old home of the language than in the new. But so soon as we recognise why this is, and why even in Scotland and Ireland peculiarities of pronunciation are retained which have long since been lost in England, we perceive that in past ages English in England must have been even more diverse than it is now, and must have tended to change more rapidly. The circumstances which, while encouraging the growth of a language, tend to uniformity of usage—as constant and ready intercommunication, widely read literature, and the like—were almost wholly wanting when our language was young; nor was the necessity apparent in any of the earlier English communities for such care in teaching as might prevent unduly rapid changes.

Those who remember England as it was but a generation ago will see that there has been even in that time a marked advance towards uniformity. The English of Northumberland was distinct from that of Yorkshire, and neither was like the English of Cumberland or Lancashire. The midland counties had various dialects; while the dialects of Dorsetshire, of Wiltshire, or of Devon were not only different from any used in the midland or northern counties, but differed widely *inter se*. In places remote from considerable towns the language spoken was almost as difficult to understand as Dutch or Frisian.

That in long past times "English as she was spoke" in different places was various and variable is shown also by the language as it was written. Bishop Edfrid, about the year 700, began the Lord's Prayer thus:

Uren fader thic arth in heofnas, sic gehalgud thin noma: so cymeth thin ric; sic thin will a sue in heofnas and in corths.

Only two centuries later the same part of the prayer was thus rendered:

Thuc ur fader the eart on heofenum: si thin nama gehalgod cume: thin rice ["c" hard]; *si thin willa on earthan swa swe on heofenum.*

We may be sure it was not difference in time only, but difference in dialect which caused this difference of form. Indeed some of the words in the more recent rendering are older in form than those in the earlier.

About the year 1160, Adrian, our only English Pope, rendered the same part of the Lord's Prayer in the following poetic form, probably the earliest rhymed poetry in the language:—

Ure fader in heaven rich * (rich = kingdom),
Thy name be halyed everlich,
Thou bring us thy michell blisse;
Als hit in heaven y doe,
Eyer in yearth been it alsoe.

(Observe the looseness of his Holiness's aspirates, as shown in "hit" and "it.")

In 1537 the Lord's Prayer, as printed for general use, began thus:—

O oure Father which arte in heven, hallowed be thy name: let thy kingdom come, thy will be fulfilled as well in erth as it is in heven, etc.

* "Ch" hard and guttural throughout.

We see here most striking evidence of the influence of printing in preventing the rapid change of a language, and in smoothing down diversities already existing. For while the earlier forms of the same sentences might have been in different languages, so diverse are they, we find in 1537 a form which differs only in spelling from the language of to-day. (I doubt whether the "e" in "oure" and "arte" was sounded in the sixteenth century, though it certainly had been in the fourteenth. Probably it was a mere survival in spelling, like the final "e" in "were," "are," &c.

But on this question of diversity of dialect in the past as at the present time in England, we have curious evidence in an address, written A.D. 1385, on this very subject:—

As it is knowe how meny maner peple beeth in this lond, ther beeth also so many dyvers longages and tonges. Natheless Walschemen and Scots that beeth nought medled with other nation, holdeth wel nyh hir firste longage and speche; but yif the Scottes, that were sometime confederate and woned with the Pictes, drawe somewhat after hir speche; but the Flemynges, that woneth on the west side of Wales, haveth lost her strange speech, and speketh Sexonliche now. Also Englishemen, they had from the begynnynge thre maner speche; northerne, southerne, and middel speche in the middel of the lond, as they come of thre maner of peple of Germania; notheless by commystion and mellynge, first with Danes and afterwards with Normans, in meny the contry longage is apayred (*corrupted*).

This ancient writer, whose very name has been forgotten (I have quoted from Dr. Hicks, of the last century, *verbatim et literatim*, except that he has "contrary" where I have written "contry"), proceeds then to inquire into the cause of this diversity. Strangely enough, he dwells on a point which I shall presently have occasion to consider—the circumstance that a foreign language changes little within a country where it is foreign, while the native tongue varies greatly:—

Hit seemeth a greet wonder how Englischemen and her own longage and tonge is so dyverse of sown in this oon iland, and the longage of Normandie is comlynge of another lond, and hath oon maner of soun amonge alle men that speketh hit aright in Engelond. Also of the aforesaid Saxon tonge that is deled (*divided*) a three, and is abide scarceliche with few uplondissche men, is greet wonder. For men of the est, with men of the west, is, as it were, under the same partie of hevene accordeth more (our author's grammar seems slightly mixed here, at any rate his meaning is not clear) in sownynge of speche than men of the north with men of the south. Therefore it is that Mercii, that beeth men of myddel Englelond, as it were, parteners of the endes, understandeth bettre the side londes, northerne and southerne, than northerne and southerne understondeth either other.

He adds some special remarks about the "maneres of speche" in different parts of the island which might be worth quoting in full if he had used "longage" we could understand. But probably the following specimen will suffice:—

All the longage of the Northumbers, and spechialliche at York, is so scharp, flitting,* and frotynge, and unschape, that we southerne men may that longage unnethe understonde

any more perhaps than we nineteenth-century men can "understonde" what sort of a "longage" our author would indicate by such "very bitter words" as "frotynge" and "unschape," or even by the more familiar "scharp" and "flitting."

Although this evidence as to the constant changes which our language has undergone, and as to the diversity of form and sound which it has presented in the past, even more markedly than at the present time, may prevent us from expecting to discover what was the English spoken in

* In my copy the word reads "slitting." It seems clear, however, that the original word was "flitting."

the time of Shakespeare or at more remote dates, yet we may still hope to recognise some at any rate among the peculiarities which distinguished the English of past times from the English of to-day. The circumstance noted by the old writer above quoted, that foreign languages retain their form—as Norman among "Englischemen that speketh hit aright"—may direct us in the search for the older forms of our familiar English, and enable us often to select between the various sounds given to the same word in different places at the present time.

Thus, when we remember that in many parts of the old British settlements in America English was almost in the position of a foreign tongue, requiring to be carefully guarded against undue change, we see that in America, even as it is now, the Englishman may seek for old forms of pronunciation which have long since died out in England itself. This is, of course, exactly the reverse of what Englishmen generally expect to find in America, and of the interpretation which they place on what they actually find. When Dickens noticed the pronunciation "air" for "are," which was commoner in America in 1844 than it is now (though it is still heard there), he took it for granted that it was a corruption. But in reality this is the old way, or rather a once widely prevalent way, of pronouncing the word; in outlying parts of England it is still very frequently heard. In like manner the strange sound of the "e" in the words "very," "American," &c., which we hear in New England and elsewhere, though not exactly the original sound, is probably nearer to it than that more usually heard in the States, and always heard in England.

We find here a sort of rule for obtaining the best information about the original character of any doubtful sound. We seek for it where the circumstances have been such that change would be least likely to occur. We can never be quite sure that no change has taken place, but we know where and how changes occur most freely and frequently, and where, on the other hand, the circumstances favour stability of pronunciation. For example, America to-day, regarded as a whole, is far less likely to show the original pronunciation of English words than one of the old colonies would have been had it retained its colonial character until now. A portion of the States where circumstances favour constant intercommunication is less likely to retain old forms than some region where the inhabitants live for the most part in the place of their birth, and neither see nor hear much of their fellow-countrymen at a distance. England itself would be the place where the ruling form of the English language would differ most from the original, precisely as the central stem of a tree extends farther from the trunk than any others. Yet in parts of England we may expect to find useful evidence of the old forms of English, while in old English literature we recognise evidence of another kind which may be exceedingly useful, if only we can ascertain just what sounds the letters employed in spelling different words were intended to represent. In Scotland, however, and in Ireland, we should have an even better chance of finding ancient forms of speech and of pronunciation, and so much the better chance as we went farther from the centres of population, to which changes introduced in the original home of the language would most readily spread.

There are some interesting considerations to which an application of this general principle (that old forms survive longest in out-of-the-way corners) seems to lead. This field of inquiry has been much less surveyed than many might imagine, who know only of the immense amount of labour which has been devoted to the study of the English language and its history. In nearly all researches into this subject, it has been taken for granted, if not actually asserted, that the language has progressed steadily from form to form. In reality, even so far as the written language, or the language of the better educated, has been concerned, this is far from representing the truth; but it is still farther from that, as regards the language spoken by the English people.

As I have said, we find at the very outset of our inquiry a difficulty arising from our inability to determine what sounds the various letters, and especially the vowels, in old books and documents were intended to represent. Spelling in old times was a free-and-easy matter. Yet we must suppose a writer, even though he altered his spelling of a word half-a-dozen times in the course of as many pages (or perhaps as many sentences), yet pronounced it always in one way. What, then, are we to understand when we find (for example) the word which we spell "great," spelled grat, grate, great, greate, gret, grete, greet, greete, grayt, grayte, and so forth, by one and the same writer, in one and the same chapter? At first it seems difficult to answer. But so soon as we remember that in the first place he must have pronounced the word in one way (except possibly that according to its position before a vowel or a consonant it may have been deprived or not of some faint trace of the sound originally represented by the final "e"), while there must have been some recognised limit in his day to the sounds which the letters a, e, ea, ee, ay, &c., could represent, we see that in this very multiplicity of spelled forms of a single word we have a means of determining both the pronunciation of words, and the force of the different letters in the spelling of the period. To take for example this particular word "great," from such evidence as the above spellings afford we may be sure the word was pronounced in the writer's time nearly if not exactly as now; and further, that while "e" represented generally in the spelling of his time the sound of "a" in "fate," "a" had already lost the "ah" sound (as in "far"), which originally belonged to it. We might be doubtful if, as in the quotation above from English of the fourteenth century, we only found the spelling "greet"; this might represent the same sound as in our word so spelled now. And in like manner "grayt" might represent a sound rhyming to "rite." Nor would "great" help us alone, for the pronunciation might have been such (so far as this spelling could tell us) as to make the word rhyme with "heat" and "feat" of to-day. But the pronunciation of "great" as at present is the only one which corresponds nearly enough with all the spellings to be admissible as the sound they were all, no doubt, intended to represent.

A single case such as this starts a long series of inquiries. If "ea," for example, represented satisfactorily in that writer's day the sound of "ea" in "great," may not other words spelled at that time with "ea," and still retaining that spelling, have been similarly pronounced? If they retained that old pronunciation until after the time when the spelling of words began to be settled as a matter of custom rather than convenience, then, though the pronunciation might change, the spelling would remain.

Let us turn to a few words thus spelled:—

We smile at Pat when he talks of the "say" and "tay," "raison" and "saison," and so forth. Doubtless it would be wrong so to pronounce these words in social converse with persons of culture. Yet when we find that these words were spelled "sea" and "tea," "reason" and "season," at a time when "e" had still its proper sound as of "a" in "fate," while "ea" did duty for a somewhat longer "a" sound, we may suspect that the Irishman of to-day simply retains a pronunciation which we have lost. This view is confirmed when we consider that *tea* is the same word which in French is represented by *thé*, almost

equivalent to *tay*, though it must be remembered that "th" in French is not, as many imagine, precisely equivalent to simple "t"; the aspirate counts for something, as every one knows who has heard French spoken properly. I say this view is *confirmed*, not that it is demonstrated, by the French pronunciation. For we must remember that French pronunciation might have changed as much as English. The probabilities are that it would. The only reason we have for trusting rather to the French than to the English spelling is that French spelling is more uniform in significance, and if we supposed *thé* in the eighteenth century was pronounced "tee," we should have to suppose all French words spelled with "é" at that time also pronounced with the "ee" sound, which is rather more than unlikely.

We find further evidence about the word "tea," because Pope makes it rhyme with "day." Since Pope was usually careful with his rhyming, insomuch that he would spoil the grammar to keep the rhyme true (writing "begun" for "began," or *vice versâ*, and the like), this is practically decisive. We see here an undoubted case in which the sound "ay" has degenerated in England into the sound "ee."

(*To be concluded.*)

THE DURATION OF OUR COAL SUPPLY.

By W. Mattieu Williams.

I PURPOSE now to conclude this series by discussing briefly this much-vexed question. My readers must all know that very widely varying estimates have been made, some giving us but another generation or thereabouts, others a few centuries of further supply. I am about to perpetrate the extreme presumption of differing from both, and asserting that the exhaustion of our coal-fields has already commenced, is rapidly proceeding, and yet will never be completed.

This apparent paradox will solve itself by considering the conditions of the problem. We began by working the best and the most easily worked seams, and we did this at a time when most of the coal now in the course of working was inaccessible, could not be worked at all. The mere removal of the water that accumulates in most of the pits now working would have been practically impossible with the pumps or buckets of our forefathers. If we were now only able to do what they could do, our coal supplies would already have ended. With such appliances coal fuel would be dearer than wood fuel, seeing that we have already worked out the coal that was commercially within their reach.

From the very beginning, when only the outcrops were grubbed, until the present time we have been gradually working out the richest and most workable of existing seams, and are doing so still; every year's working increases the difficulty of obtaining the next year's supply, and increases its cost, unless improved appliances and means of working effect a proportionate economy. This will go on continually until the cost of obtaining home supplies is so great that it will be cheaper to import foreign coal than to work our own. The American coal-fields contain quite a hundred times as much coal as ours. China probably has nearly as much as America, and so on with other parts of the world. The principal difference between our coal wealth and that of other nations is personal rather than physical. It is not our greater supplies underground, but our greater energy in raising them to the surface and using them productively, that has placed us at the head of coal-producing and coal-using nations.

It is true that this general action of first working the best coal is not without exception. There are bits here and there that for exceptional reasons have remained unworked, as where, for instance, the getting of coal would interfere with the game preserves of Squire Mohawk, whose superior "culture" and high social rank have rendered it necessary that he should devote himself to bird-slaughtering and other blood-shedding amusements. These exceptions do not, however, practically affect the result, owing to the necessary operation of the economic law that the market value of any openly sold commodity is determined by the cost value of the most costly portion which is required to supply the demand.

As we proceed to deeper and deeper seams, a time will arrive when the cost of vertical transit from seam to surface will exceed the cost of horizontal transit across the Atlantic. In vertical cost I include not merely haulage, but all the cost connected with deep pits and deep workings. But here again we have a complication. Before this exact state of things arrives, *i.e.* when our coal shall cost more to bring it up to the pit bank than to import from other countries, there will be a long period during which it will cost less to bring coal from America to our south-western ports than to raise it from our own coal-fields and carry it to these places by rail.

People living in such places as Plymouth, Dartmouth, Portsmouth, Brighton, London, &c., and paying 20*s.* to 30*s.* per ton for coal, are apt to forget that as much as 75 per cent. of these prices are for carriage and middle profits, that the price of coal at the pit's mouth ranges even now from 5*s.* to 7*s.* per ton. There are coal seams close to the sea coast in Nova Scotia, which might, if sufficient enterprise existed there, be put on board specially-constructed ships, and delivered in our south and west coast towns, or in London, at about 15*s.* per ton. Even lower estimates have been made, and experience shows that in respect to such carriage the facts commonly fall below the estimates. Some years ago the oil masters of Scotland and North Wales (of whom I was unfortunately one) sent out a special commissioner to learn the lowest cost of importing refined petroleum from Pennsylvania to London. His estimate of total cost, including barrels, insurance, &c., was 1*s.* to 1*s.* 2*d.* per gallon. Allowing price at the wells to be 6*d.* per gallon, we felt safe to compete at 1*s.* 6*d.* I have just finished a barrel of the best water-white kerosine which I purchased last autumn *retail* in a London suburb at 6½*d.* per gallon. This includes prime cost, carriage, barrel, insurance, and two profits. I have no doubt that when the carriage of coal across the Atlantic to London becomes fully developed, the freight will be reduced to 4*s.* or 5*s.* per ton, or about half the present railway rates and truck hire from Newcastle or Durham or Derbyshire.

I also believe that the reason why this has not already occurred is merely an artificial one. It is simply because the capitalists of the United States and Canada imagine that a new country can better nourish its infant industries by excluding foreign products (even those that feed the infants) than by developing their own natural resources by the free action of natural selection.

But even when the extreme condition is fulfilled, when the average depth of the Newcastle pits is, say, 3,000 feet greater than that of the American pits near the coast, and our vertical difficulties equal their horizontal difficulties of 3,000 miles, we shall not even then cease working our coal, for by this time the Americans will be exhausting their most favourably situated and richest seams, and then both they and we will be proceeding towards the more and more costly, until at last wood fuel will be cheaper than coal at even moderate distances from the mouths of coal pits.

While this is proceeding we shall gradually drop those industries which demand the greatest supply of coal in proportion to value of result. Thus our blast furnaces, and other smelting furnaces, will be blown out. We shall cease to make crude pig iron and other crude metal, the cost of which chiefly depends on that of coal and ore, but not being addicted to the misdirection of industry by legislative interference, we shall develop our industries in the direction of higher elaborations of the raw material. One ton of watch springs demands more industry and has higher value than a thousand tons of pig iron, while the pig iron demands five hundred times as much coal for its production. Therefore by the aid of unfettered natural selection, and the survival of the fittest, the blast furnaces will be blown out, and an evolution of those industries demanding more labour, more skill, and more intelligence, and less fuel, will proceed, provided we retain those energies which at the proper time brought our coal to the surface, and created the steam-engine to pump the pits when more powerful pumps were needed, and also created railways and locomotives to carry it throughout the land when such carriage was demanded.

I have always regarded, and frequently described, the notion that our manufacturing supremacy depends on our coal supplies as a gross popular fallacy, and one which at the present day may be very mischievous if it induces us to lean upon such a rotten staff. The sooner we understand that any physical advantage in coal supply we ever possessed has already gone, the better for our future progress. It is not desirable that we should continue to be the coal-cellar of the world, nor that we should depend on the coarser industries that are so voracious of fuel.

Our old form of "manufacturing supremacy" is becoming a national curse. We import more than a million of eggs daily, and corresponding quantities of butter, cheese, fruit, and other agricultural produce. We obtain these in exchange for factory products, for goods that are hatefully produced at the cost of national degeneracy by the crowding of millions of miserable wretches into the slums of manufacturing towns, where their unhealthy work and surroundings cause them to produce stunted, scrofulous, and vicious offspring. At the same time we are extending the big factory and steam-engine system of work to our agriculture, and thereby converting into a prairie a country that should be a garden. Farming is becoming one of the lost arts in England, our so-called farmers being mere graziers, wholesale manufacturers of mere beef and mutton.

Coal worship has promoted the exaggerated use of grossness in everything; big mechanical work done by big engines in big factories, producing big incomes at one end and big union workhouses at the other. Let us endeavour to supersede these by small farms highly worked by peasant proprietors, and small workshops belonging to highly skilled and artistic artisans, with good wages all round.

King Coal must be dethroned, and with him will go his grovelling money-grubbing courtiers, to be replaced by a commonwealth of individual industrial skill and intelligence naturally fitting a small island densely populated, and with a climate so moderate in all directions that a full day's work may be done on any day throughout the year.

Let other nations do the big things, the tall work, and the coarse work—let us do the best. But we cannot step into this position at once. This progress, like that of our coal exhaustion, with which it is intimately connected, must be gradual and endless. Instead of relying on coal or iron ores or any other physical advantages, we must prepare for their declining supply by developing more reliable and enduring sources of prosperity—the intelligence of *all* the people, especially the workers. A rich man can afford to be a fool, and the nation can afford to let him play the fool provided he is a harmless fool; but not so with the industrial millions. They must be highly educated in order to do the higher work demanded under the new conditions. They determine the progress of the nation, whether it has little coal, or much coal, or no coal. If we understand this and act upon it, the gradual exhaustion of our coal supplies will be a national blessing. We shall have fewer flunkey-feeding millionaires — or, better still, none; and fewer paupers—or, better still, none; but the nation will be enriched by consisting mainly of skilful and intelligent wealth-producers sufficiently well paid to obtain rational comfort, but not sufficiently to become sensual sybarites.

EASY STUDY IN THE DIFFERENTIAL CALCULUS.

SUGGESTED BY THE "SATURDAY REVIEW."

IN my "Easy Lessons in the Differential Calculus," written specially for beginners, and rather to show them how well worth studying the Calculus is than as a treatise on that important part of mathematics, I explain in Lesson I. and illustrate by an example what is meant by "differentiation," and in Lesson II. what is meant by "integration." The particular example selected is the fall of a body under the action of gravity, so that in these two short lessons I consider only the differential coefficient of the familiar expression $\frac{g t^2}{2}$, representing the space fallen through in time t under gravity. In Lesson III. (only four pages in length) I take another simple expression $(a y - y^2)$, for differentiation, "before proceeding to obtain the differential coefficients of various familiar functions." At this very early stage, *before I had given the differential coefficients of any of the simple functions* (attended to in Lessons IV. and V.), I thought it well to show how even the pre-elementary matter already dealt with could be used in solving a familiar problem or two. Having only the differential coefficient of $(a y - y^2)$ available for the purpose, I was naturally somewhat limited in my choice, especially as I had barely begun to show the relations between differential coefficients and the increments or decrements of variable quantities. I selected two cases which involved the expression $(a y - y^2)$ or $y(a - y)$; the first related to the rectangle between two lines of length, y and $(a - y)$, the problem being the determination of the value of y, in order that the rectangle represented in area by $y(a - y)$ might be a maximum. Every geometrician knows the problem and its answer, and half-a-dozen ways of solving it. Every algebraist knows what value of y makes the expression $(a y - y^2)$ a maximum, and how to prove that this happens. But of course the illustration of the special point I was considering would be none the worse for the familiar character of the problem dealt with—perhaps rather the better. The point to be illustrated was the way in which the differential calculus can be applied to problems, which, dealt with geometrically or algebraically, require usually some special device planned to meet each case as it arises, which is true even for these very simple cases.

However, the *Saturday Review* has thought it fair to treat as follows this simple illustration, given at the very beginning of my subject, before I had dealt with the simplest of the differential coefficients, and specially described as merely a preliminary example of the method of using the differential calculus:—

Lesson III. is headed "Illustrations of the Use of the Calculus" [the reviewer might have noticed, had he cared to be honest, that

Lesson IV. is headed "Differentiating Simple Functions"; Lesson V. the same; Lesson VI., "Differentiating Composite Functions"; and that Lessons VIII., X., XI., XII., and XIII. are all devoted to "Illustrations of the Use of the Calculus." However, it suited him better to describe Lesson III., preceding even the simplest differentiations, as though it were the only lesson relating to the use of the Calculus]. When we turn to see how Mr. Proctor applies this great engine, we find only two little problems, neither of which requires anything of the sort. The first is a question about a straight line. In this there is nothing wanted beyond the fifth proposition of Euclid's second book to do easily in two lines or three, what Mr. Proctor occupies a printed page with. Need one have a telescope fetched, tripod and all [strange idea this man has about an astronomer's telescope] to look at the clock on the chimney-piece? The second problem or "illustration" is equally simple, and equally undeserving of having so great an engine set in motion; in fact, it is easily shown to depend on the same proposition of Euclid when a rectangle is interpreted algebraically, and can thus be done more quickly than by Mr. Proctor's mode [meaning "method," it may be presumed].

As a matter of fact, the geometrical problem would not require the second book of Euclid at all, though it could be given as a corollary to the problem mentioned by the *Saturday Reviewer*. The geometrical solution might, for example, run as follows, without going beyond Book I.:—

Let A B (fig. 1) be the line, C its bisection, D a point in A C. Complete the square A C F E, and the rectangle

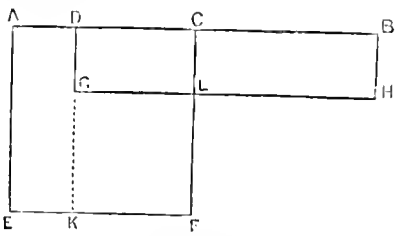


Fig. 1.

D B H G, having the side B H equal to A D. Produce D G to meet E F in K. Then the rectangle A K is equal to the rectangle C H, since A D = B H and A E = A C = C B). Add G C. Then the rectangle G B is equal to the figure E D L, or is less than the square E C. Q.E.D.

Algebraically, the proof of the proposition that $(a\,x - x^2)$ is greatest when $x = \frac{a}{2}$ can hardly escape anyone who has ever solved a quadratic equation. It runs simply thus:—

$$a\,x - x^2 = \frac{a^2}{4} - \left(\frac{a}{2} - x\right)^2$$

which is manifestly greatest when $x = \frac{a}{2}$. Q.E.D.

Now my page of printed matter (really two-thirds of a page, but that is near enough for the *S. R.*) gives not only the solution of the problem, but an explanation of the principle on which the application of the differential calculus to such problems depends—this being what I desired to show, not how to solve a problem which involves in itself no difficulty whatever. "Mr. Proctor's mode" or method consisted in showing at the very beginning of his little book how the differential calculus is applied to problems of a certain class. (For this a page would not have been too much, though little more than half a page sufficed.)

Albeit, if one can imagine a mathematician in any momentary doubt as to the value of x which will make $(a\,x - x^2)$ a maximum, one would certainly expect him to apply the differential calculus, because this would save him all trouble. Antecedently it would be doubtful in most cases of the kind whether a geometrical or algebraical method could be lit upon easily—and it may be remarked in passing that when we are told that this or that problem, readily solved by the differential calculus, can be solved geometrically or algebraically, we may generally be sure (if it has any difficulty in it) that the geometrician or algebraist has first solved it by the calculus, or seen some one else's solution, and has then inquired how the known result could be obtained geometrically.

A mathematician proceeding on the sensible plan of applying the only method which is sure and easy, without troubling himself about its being a "great engine" (which is sheer nonsense), would have easier work than either the geometrician or algebraist, easy though (as we have seen) their task would be. The problem is:—"If $y = a\,x - x^2$, when is y a maximum?" The "great engine" does the work thus (the engineer knowing that for any expression to be a maximum its differential coefficient must vanish):—

$$\frac{d\,y}{d\,x} = a - 2\,x = o\,; \quad \therefore\ x = \frac{a}{2}.$$

Of course the easier the example selected, the less favourably the work of the "great engine" compares with the work of any smaller engine capable of effecting it. Still, the above is not *very* hard work; and be it noticed that it involves much less thought than even the simple geometrical and algebraical methods presented earlier, little though the thought be that they require. (We see that even a *Saturday Review* mathematician can puzzle out one of those solutions, though, to be sure, he makes a large fuss over his small achievement, and his solution is far from being even the best of its kind—always supposing it original.)

This particular example illustrates the use of the "great engine" ("I thank thee," *S.R.*, "for teaching me that word") quite as well as one I give further on—in Lesson VIII.—which, treated as a geometrical problem, would be more difficult. (I would back it to beat the *Saturday Reviewer*, though I think—but cannot be sure till I have tried—that a geometrician would not take long over it. I will try presently.) It is the problem of determining the greatest cone which can be inscribed in a sphere of radius r. Here the solution by the differential calculus runs easily and smoothly as follows:—

Taking x for the height of the cone, we get for its volume (y) the expression

$$y = \frac{\pi}{3}\,(2\,r\,x^2 - x^3)\,;$$

whence $\frac{d\,y}{d\,x} = \frac{\pi}{3}\,(4\,r\,x - 3\,x^2) = o$ (for a maximum or minimum).

So that either $x = o$, giving obviously a minimum,

or $x = \frac{4\,r}{3}$, giving the required maximum.

As some readers may like to see how this problem is to be solved geometrically, I give the solution in that way,

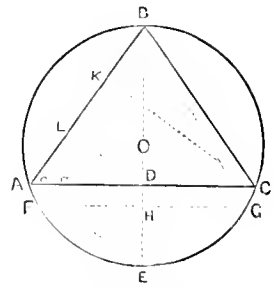


Fig. 2.

fearing lest the weakling mathematician of the *Saturday Review* should waste a month of his valuable time in vainly attempting to find one:—

Let A B C (fig. 2) be a section of the maximum cone through O, the sphere's centre; B D, the cone's height.

Let F B G be the section of a cone, having the height B H very little greater than B D. Let F B, A C, intersect in a, and draw F c perpendicular to A a. Then obviously A a F is ultimately a triangle similar to B C A. [The angle A a F=angle B a C=ult. angle B A C; and angle a A F=angle A B C.] Draw C K perpendicular to A B, corresponding, in the larger triangle, to F c perpendicular to A a in the smaller.

Now, the right-angled triangles F c a and B D a being similar, we have

$$\text{F } c : \text{B D} :: a c : a \text{ D};$$
$$\text{whence F } c \,.\, a \text{ D} = \text{B D} \,.\, a c.$$
$$\therefore \text{F } c \,.\, (a \text{ D})^2 = \text{B D} \,.\, a c \,.\, a \text{ D} \quad (1)$$

But if the cone B A C is a maximum, the increment in passing to the cone B F G must be equal to the decrement; whence ultimately (when A D=c D=a D, &c.)

$$\pi \,.\, \text{F} c (a \text{ D})^2 = \pi \frac{\text{B D}}{3} \,.\, \text{A } a \,.\, 2 a \text{ D} \quad (2)$$

Comparing (1) and (2) we see that for a maximum we must have—

$$a c = \tfrac{2}{3} \text{A } a$$
or
$$\text{A K} = \tfrac{2}{3} \text{ A B} = 2 \text{K B}.$$

Join E A and draw D L perpendicular to A B, bisecting A K in L (because A D=D C). Then since L D and A E are parallel and B L=$\frac{2}{3}$ A B

$$\text{B D} = \tfrac{2}{3} \text{ B E} = \tfrac{4}{3} \text{ B } o;$$

the same result as by the "great engine." But the "great engine" did the work more easily.*

The *Saturday Review* having displayed its profundity thus effectively, proceeds in the following strain:—

> In the table of contents, we were astonished to find the heading "Elliptic Integrals," [In reality the heading is "Elliptic and Hyperbolic Integrals," but to have mentioned this would have baulked the *S. R.'s* attempt at sarcasm.] but on looking up the chapter found not a word about them, as ordinarily understood, but only a proposition about finding the area of an *ellipse* by integration. Must we conclude that the author did not know what the phrase meant? [The *S. R.* naturally leaves it to be understood that we must come to this distressing conclusion.]

Now if I were given to betting, I would be prepared to offer a tolerably large wager that the writer of this *critique* (save the mark!) does not in the least know what an "elliptic integral," as commonly understood, really is, or why it is called an "elliptic integral," or for what purposes the so-called "elliptic functions" were discussed by Legendre. The way in which he emphasises the word "ellipse" (for the italics are his) shows this clearly enough. Evidently that sarcastic emphasis would have come in quite as effectively if he had had to say that he only found a proposition about rectifying the arc of an *ellipse* by integration—though such a proposition would have related unquestionably to "elliptic integrals" as commonly understood.

The fact is that the phrase "elliptic integrals," as commonly used, is a convenient misnomer. In the rectification of an ellipse (centre as origin of co-ordinates, major axis 1, and eccentricity e), we obtain the equation—

$$s = \int \sqrt{\frac{1 - e^2 x^2}{1 - x^2}} \, dx \text{ (where } s \text{ represents the arc).}$$

and putting $x = \sin\theta$, so that $dx = \cos\theta \, d\theta$, we get

$$s = \int \sqrt{1 - e^2 \sin^2\theta} \, d\theta.$$

Now the term "elliptic integrals" is applied conveniently, but not correctly, to expressions of the form,

where
$$\int f(x, \text{X}) \, dx$$
$$\text{X} = \sqrt{a + b x + c x^2 + d x^3 + e x^4}$$

d and e being not both equal to zero. Such integrals can be classified into others, of which all not expressible by algebraic, logarithmic, or inverse trigonometrical functions, have one of the three forms:—

(i) $\int \frac{d\theta}{\sqrt{(1 - c^2 \sin^2\theta}}$ (ii) $\int \sqrt{(1 - c^2 \sin^2\theta} \, d\theta$ and

(iii) $\int \frac{d\theta}{(1 + a \sin^2\theta)\sqrt{(1 - c^2 \sin^2\theta}}$

the integrals being all taken between the limits θ and o.

The second form is that already obtained for the rectification of the arc of an ellipse; and for this reason, by no means a perfect one, these integrals are all, for convenience, called "elliptic integrals."

But if mathematicians may for convenience call several orders of integrals "elliptic" because one among them really is elliptic, as appearing in dealing with the rectification of the ellipse, they are surely free if it suits their convenience (as it did mine in the present case) to call certain integrals "elliptic" which are really elliptic, as appearing in dealing with the quadrature of the ellipse—especially if (as I did) they prevent all possibility of mistake by combining with the term "elliptic," thus used, the term "hyperbolic" similarly used, because it relates to an order of integrals appearing when we are dealing with the quadrature of the hyperbola.

I wanted a convenient heading for a chapter on integrals relating to the ellipse and hyperbola, so I called them "elliptic and hyperbolic integrals." I knew that on the one hand the readers for whom I was writing could not be in any way misled by this nomenclature, especially as the chapter itself sufficiently explained the use of the words. I was equally well assured that no mathematician acquainted with the technical (but scarcely correct) use of the phrase "elliptic integrals" could be for a moment misled, if by any chance he looked over my simple pages. And although the idea did occur to me that critics of the *S. R.* class—neither learners nor learned—might cavil, that did not in the least trouble me. I knew that on the one hand I was certain to encounter cavillings of that sort, and that on the other I should know well how to treat them, and should even be able to apply them to a useful purpose, as I am now doing.

That the notice I have been dealing with is feeble and spiteful may be explained by the fact that it appears in the paper called the *Saturday Review*—by some (by others less euphoniously). Does this remark sound unmannerly? For my own part, I think it does. I withdraw it. I was only trying an experiment. The *S. R.* says that the defects (invented) which it pretends to recognise in my two small and unpretentious books, "First Steps in Geometry" and "Easy Lessons in the Differential Calculus," "may be explained by the fact that they consist of papers written for the magazine called KNOWLEDGE." I wanted to see how such a remark applied even to the *Saturday Reviler* might sound. I cannot think that it sounds well.

As for the remark thus rudely made by the *S. R.*, it chances to be untrue—no very strange chance of late, when the *S. R.* is in question. The substance of the two books dealt with was not written for KNOWLEDGE, though it appeared in KNOWLEDGE. (The *Saturday Review* never could

* Here are two easy problems which either the beginner in the Differential Calculus or the geometrician can solve: (1) Determine the maximum cylinder which may be inscribed in a given sphere. (2) Determine the cylinder of maximum surface which may be so inscribed.

* If under the radical higher powers of x appear than the fourth, the integrals thence deducible are called "ultra-elliptic" or "hyper-elliptic."

be logical, even in its better days.) Both works were written long before Knowledge began its career. They were submitted by Messrs. Longmans to the Rev. Mr. Griffin, of Ospringe, a Senior Wrangler of long standing and well known as a mathematician of great power. After carefully examining both works, he recommended Messrs. Longmans to accept them for publication, and accordingly an agreement was drawn up in regard to these two works, and this agreement—which lies before me as I write—bears a date preceding the issue of the first number of this magazine. The effort of the *S. R.* to be disagreeable was well tried, however.

THACKERAY AND THE "SATURDAY REVIEW."

"HERE is my *Saturday Review*, and in an American paper subsequently sent to me, I light, astonished, on an account of the dinners of my friend and publisher, which are described as 'tremendously heavy,' of the conversation (which does not take place) and of the guests assembled at the table. I am informed that the proprietor of the *Cornhill*, and the host on these occasions, is 'a very good man but totally unread,' and that on my asking him whether Dr. Johnson was dining behind the screen, he said, 'God bless my soul, my dear sir, there's no person by the name of Johnson here, nor any one behind the screen,' and that a roar of laughter cut him short. I am informed that I have touched up a contributor's article; that I once said to a literary gentleman, who was proudly pointing to an anonymous article as his writing, 'Ah! I thought I recognised your hoof in it.' . . . Then the graceful writer passes on to the dinners, of which it appears the editor of this magazine 'is the great gun, and comes out with all the geniality in his power.' Now suppose this charming intelligence is untrue. Suppose the publisher never made the remark beginning, 'God bless my soul, my dear sir,' &c., nor anything resembling it? Suppose nobody roared with laughing. Suppose the editor of the *Cornhill Magazine* never 'touched up' one single line of the contribution which bears the mark of his hand? Suppose he never said to any literary gentleman 'I recognised your hoof' in any periodical whatever? . . . Suppose this back door gossip should be utterly blundering and untrue, would any one wonder? Ah! if we had only enjoyed the happiness to number this writer among the contributors to our magazine, what a cheerfulness and easy confidence his presence would impart to our meetings! . . . As dear Sam Johnson sits behind the screen, too proud to show his threadbare coat and patches among the more prosperous brethren of his trade, there is no want of dignity in *him*, in that homely image of labour ill rewarded, genius as yet unrecognised, independence sturdy and uncomplaining. But Mr. Nameless, behind the publisher's screen uninvited, peering at the company and the meal, catching up scraps of the jokes, and noting down the guests' behaviour and conversation—what a figure is his! *Allons*, Mr. Nameless! Put up your note-book; walk out of the hall, and leave gentlemen alone who would be private, and wish you no harm."—Thackeray in the *Roundabout Paper* "On Screens in Dining-rooms."

[This paragraph, as it stands, would give an unfair idea of Thackeray's strictures. The *Saturday Review* in 1860 was a powerful paper. Those were the best days mentioned by Matthew Arnold in his praise of the American paper *The Nation*. In the article quoted Thackeray speaks of the *Saturday Review* as piquing itself ("and justly and honourably in the main") on its gentlemanly as well as its literary character. It was then, moreover, usually manly, though it was always characterised by the weakness indicated by declining ever to correct or admit mistakes, to which, in common with all things human, it was liable. We find even a man of science like Darwin, though remarking with reference to a *critique* in its pages that "One cannot expect fairness in a reviewer, so I do not complain &c.," recognising real worth in a *Saturday Review* criticism of his "Origin of Species." (This seems so strange, *now!*) It is true that the criticism (*not* the *critique* as a whole), though true, did "not at all concern the main argument." Still the change indicated by such evidence of what the *S. R.* once was is startling, even to us who have been able to note its progress. Imagine a paper once so conducted that a Darwin could learn a lesson (on a point of detail) from its pages, reduced to such a point that Sir William Jenner should be spoken of by one of its "young buccaneers" as the inventor of vaccination!—Ed.]

BRITISH AND IRISH FAIRIES.

By Stella Occidens (Mary Proctor).

When Puck appears and spins him round,
And glides amid the dance,
Behind him, with him to rejoice,
Hundreds of sprites advance.

AMONG the superstitious folk in the North of England it is supposed that fairy elves haunt the woodland glens, and on moonlit nights they are to be seen dancing a merry roundelay* on the green sward. If any one has the courage to run in their midst and steal the drinking-glass they use at these festivals, it will bring good luck, "supposing he can carry it across a running stream." At Edenhall, in Cumberland, a butler, whilst drawing water at a well, was very much surprised at seeing some of these little beings amusing themselves on the grass. They had left their drinking-glass upon the margin of the well, and he ran away with it, though hotly pursued by the fairies. Finally he outran them, and they vanished crying:—

If that glass do break or fall,
Farewell the luck of Edenhall.†

Oberon, king of Fairyland, and his wife Titania, held many a moonlight revel in days of yore. On one occasion the tiny royal pair had a dispute, but Oberon called his son Puck to his assistance, and peace was soon restored in Fairyland. Puck, or Robin Goodfellow, was a domestic sprite, like the Scandinavian *nisse* and the Scotch brownie. He was famous for his merry pranks, so much so that his father threatened to punish him, and the little imp ran away from home. He wandered through the woods, and presently feeling tired, he lay down on the ground and fell asleep. When he awoke he found a scroll lying on the ground. It had been placed there by his father Oberon, and contained verses written in letters of gold, telling him that he could have all he desired,‡ and the power of changing

* [The word *roundelay* signifies a round dance as well as a song in which the first strain is repeated. The English spelling alters the true word *rondelet*, so as to suggest the idea that a lay or song is necessarily signified.—Ed.]

† This very nearly happened, for one day the Duke of Wharton, having taken a drink out of the magic glass, carelessly let it fall, but the butler caught it in his napkin.

‡ The earliest recorded instance of agony advertising: "If Puck will return to his distressed family all will be forgiven and he shall do as he pleases."

himself into any shape, but he was not to harm the needy nor the honest, but rather to help them. Robin often took advantage of his power, and delighted in playing tricks. One day he went to a wedding as a fiddler, and caused quite a commotion during the evening by putting out the lights. All being in darkness, "hee strucke the men goode boxes on the eares." Each thought it was the other, and they began fighting, at which the naughty elf did laugh right merrily. The women also began to scratch each other like so many wild cats, and it was some time before peace was restored. At supper-time Robin once more disgraced himself by turning himself into a bear, and frightening all the people away. Being both hungry and greedy, he ate all the supper provided for the evening. Sometimes he was very good-natured, and would help the maids with their work—that is, if they left out some cream for him at night.

In West Cornwall, among the coal mines, there are harmless little elfish beings called Pixies, Spriggans, and Knockers. The latter are supposed to be the souls of the Jews who crucified Christ, and were sent by the Romans to work as slaves in the tin mines. They haunt the richest mines, and the miners have heard them knocking and singing underground, which is a sure sign of good luck. These little beings are very ugly, and apt to be spiteful. One day a man named Tom Trevorrow heard the Knockers just before him whilst he was working underground, and he roughly told them "to be quiet and go," upon which a shower of stones fell suddenly around him. Not only did this give him a dreadful fright, but from that day he had such bad luck that he had to leave the mine.

The Piskies are said to be half-witted people who have died, when they were not good enough to go to heaven. They go about in parties, and delight in mischief. On gloomy nights they lead people a sad dance, over hedge and ditch, led by

> Jack o' the lantern! Joan the wad,
> Who tickled the maid and made her mad.

One night a Polperro lad was returning home across the fields, when he heard a chorus of squeaking voices saying, "I'm for Portallow Green," and in a moment he was surrounded by a throng of laughing piskies. He followed them, until they cried, "I'm for the King of France's cellar." He suddenly found himself in a large cellar, and joined his mysterious companions in tasting the richest wines. They strolled through the palace, and the lad "could not resist the temptation of pocketing one of the rich silver goblets from the table in the dining-hall. This all took place in five minutes. Then a signal was given, and in a moment he was whisked home with the silver goblet, to prove the truth of his tale.

Not long ago a woman of Mousehole (a village near Penzance) saw [or said she saw] troops of small people, not more than a foot and a half high. They would come out of a hole in the cliff on moonlight nights, but would scamper back again if anyone came near them. Mothers often told their children that if they went under cliffs by night, the small people would carry them to "Dicky Danjy's Hole." These little beings will thresh the farmer's corn, and do the servants' work for them at night. But should anyone notice them, or try to reward them for their services, they leave the house for ever, saying*—

> Pisky fine, Pisky gay,
> Pisky now will fly away!

The same occurs among the Irish fairies; and Shirley Hibberd relates an amusing story told by an Irish servant from Galway. Her father was a blacksmith, who had won the goodwill of the fairies by helping benighted travellers. If he left any work in his smithy overnight they would finish it for him. The family were often aroused by hearing "vigorous pulling with the bellows, and hammering on an anvil"; but the fairies always replaced the tools they had used in the night, and left the smithy in perfect order. If the fairies were disturbed in their work there was trouble. One evening the blacksmith went to the smithy for some medicine he had left on a shelf. The good people had just begun their work, but his entrance put them to flight. As a result a series of misfortunes took place. The following day "a black pig died, little Tike took the measles, and for several nights the people in the house were kept awake by a noise like peas and pebbles being thrown at the window."* These fairies dwell in rocks, and are so small and dainty "that a dewdrop trembles beneath their light weight." In the fairy legends of the South of Ireland, Crofton Croker tells us that "they are only a few inches high, and almost transparent."

The Banshee watches over a particular family; the Cluricane is an evil elf who takes the form of an old man, and knows where to find hidden treasures; and the Phooka is a diabolical spirit who sometimes appears as an eagle or a black horse, and hurries any one he gets hold of to destruction.

Fairies that are only seen on moonlight nights are laughter-loving mischievous sprites. A story is told about a carpenter, called Davy Hanlan, who declared that he came across some of these beings. He was on his way home, and, worn out with the day's work, he rested on a bridge. The moon had risen, and the hills and valleys were bathed in a silvery haze. The lights and shadows were so exquisitely blended that it appeared "to be the work of an enchanter's wand." Suddenly Davy heard voices, and "saw a group of dwarfish beings emerging from the gloom, and coming rapidly towards him, along the green marsh that borders Maudlin stream." As they approached the bridge they cried out, "Where is my horse? Give me my horse." In the twinkling of an eye they were all mounted. Davy also said "Give me my horse," and he found himself astride a piece of wood. Gliding smoothly through the air, the whole party arrived in a large city just as the bells had tolled the "magic hour of midnight." They went from house to house, trying all the doors until they came to one which had a large wine-cellar. The door had been left open, so they did not hesitate to enter and make themselves perfectly at home. They had a merry time: wine-bottles were broken, bungs flew out, and the walls re-echoed their peals of laughter. Davy looked on in wonder, and, thinking that he might as well take his share in the fun, he asked a rather agreeable fairy if he could not have some wine, as he was very thirsty. "When I shall have done," said the fairy, "I will give you this goblet, and you can drink." She had scarcely handed it to him, when the leader gave the word of command:—

> Away, away, my good fairies away!
> Let's revel in moonlight and shun the dull day.

They all mounted their horses, and, in the twinkling of an eye, Davy found himself on the bridge again, with the silver goblet in his hand.† Tory Island, Donegal, is a favourite haunt of the good people, "and no Toryite will go out alone after dark. Till lately there lived at Killult a woman who used to be carried off by the fairies. One dark night, when they were out looking for her with torches, Owen Kelly of Molin rescued her: she was in the grasp of

* *Folk-Lore Journal*, vol. v., part iii., p. 185.

* *Notes and Queries* for 1852, vol. vi.

† *Notes and Queries* for 1853, vol. vii., p. 62.

a little man with a red cap, who disappeared as he came up."*

The fairies also steal little babies, leaving ugly, deformed changelings in their place. This practice is referred to by Chaucer, Drayton, Shakespeare, and Hogg. The latter wrote the ballad of Kilmey, about a little girl who was spirited away to Fairyland, and never seen again. The fairies in Scotland have the same uncanny trick. The ballad of Tamlane relates the adventures of a little boy who had been stolen by the fairies, but was [illegible]. The capture took place in Selkirk in the [illegible]. It was Hallowe'en, a time when all fair maidens are afraid to venture out lest the fairies should capture them. A lassie named Janet, the fairest of all her kin, was braver than the rest. When night came she walked to a well in Canterhaugh, where the fairies held their revels. Her little sweetheart, Tamlane, had been stolen by the queen of the fairies when Janet was a little girl, and she always hoped to meet him again. When she arrived at the well she saw a milk-white steed which she recognised as Tamlane's. She waited patiently, plucking roses meanwhile :—

She hadna pu'd a red, red rose,
A rose but barely three,
When up and starts a wee, wee man
At Lady Janet's knee.

This was Tamlane, who assured her of his constancy to her during his long absence, and made a solemn vow to wed her, but on certain conditions. She had to wait for him till midnight at Miles Cross, for at that time all the fairies would pass by. She would know her sweetheart by his milk-white steed and the gold star on his forehead. As he passed by she had to clutch hold of him and hold him fast, for he would be changed into a snake, a dove, and a swan, though finally resuming his own shape.

Gloomy, gloomy, was the night, and eerie was the way,
As fair Janet in her green mantle, to Miles Cross did gae,
There's haly water in her hand, she cast a compass round;
And straight she sees a fairy band, come riding o'er the mound.

All happened as Tamlane predicted, and Janet won him for her own, to the great grief of the fairy queen and her band, with whom he had become a great favourite.

The Scottish elves have the same traits as the Irish, and are divided into Cluricanes, Kelpies, Spunkies, Brownies, and others. A great resort of the more fiendish among these beings was Mucklestane Muir,† and rings are still pointed out "on which neither grass nor heath ever grow, the turf being as it were calcined by the scorching hoofs of the diabolical partners." The Brownie is a domestic sprite, somewhat like the being mentioned in the charming ballad of the Count of Kildare :—

Brown dwarf that o'er the moorland strays,
Thy name to Kildare tell?
The brown man of the muirs who stays
Beneath the heather bell.

Gigantic Fossil Turtle.—The remains of a gigantic fossil turtle have been discovered in the middle pliocene strata of Perpignan, and the creature has just been described by the distinguished palæontologist, M. Gaudry, before the Paris Academy of Sciences. The shield or carapace of the reptile was over four feet long, so that it was equal in size to the Madagascar fossil turtles. M. Gaudry considers that the survival of this great turtle down to the mid-pliocene period (shortly before the glacial epoch commenced in the Northern Hemisphere) shows that the south of France must have enjoyed a warm climate even then.

* *Folk Lore Journal*, vol. v., part i., p. 68.
† Sir Walter Scott, "The Black Dwarf."

BACON'S OWN CIPHER.

THE *Pall Mall Gazette* has done good service in calling attention, in an article entitled "The Mammoth Mare's Nest," to the way in which Mr. Ignatius Donnelly has blundered over Bacon's real cipher, while pretending to have discovered, through his exceptional profundity, a cipher which has never had any existence. In the following passage that paper gives a correct account of Bacon's well-known five-letter cipher (which anticipated in principle the Morse alphabet), and of Mr. Donnelly's foolish blundering over it—which would discredit an intelligent ten-year-old schoolboy. It is to be noticed, however, that the examples of the use of the cipher are not really taken from the "De Augmentis," but from one of the translations—Bacon's Latin Alphabet being altered into English (with W), and his direct quotation from Cicero (*Ego omni officio ac potius pietate erga te*, &c.) being translated. But this, while indicating the quality of Bacon's cipher in being able, as he said, to indicate *omnia per omnia*, brings out in a very striking way Mr. Donnelly's ignorance of Bacon's real work, and the stupidity of his feeble attempt to puzzle out a perfectly plain problem already fully and most lucidly solved by the writer whom he pretends to expound. Nothing funnier, perhaps, has ever been heard of in paradoxical literature than Mr. Donnelly's shorn return from his wool-gathering expedition, unless it be the splendidly big bull he has perpetrated in striving to prove that Bacon most laboriously concealed what he was most anxious to disclose. [Not even Bacon's acumen could have foreseen the appearance in the world of such a genius as Detractor Donnelly.]

Says the *Pall Mall Gazette* :—

In order to illustrate Bacon's familiarity with the principles of secret writing, Mr. Donnelly gives an account of the famous five-letter cipher, quoting from the English translation of the "De Augmentis." The key he gives quite correctly, and to make clear his error we must reprint it :—

A—a a a a a ...	B—a a a a b ...	C—a a a b a
D—a a a b b ...	E—a a b a a ...	F—a a b a b
G—a a b b a ...	H a a b b b ...	I & J—a b a a a
K—a b a a b ...	L—a b a b a ...	M—a b a b b
N—a b b a a ...	O—a b b a b ...	P—a b b b a
Q—a b b b b ...	R—b a a a a ...	S—b a a a b
T b a a b a	U & V—b a a b b ...	W—b a b a a
X—b a b a b ...	Y—b a b b a ...	Z—b a b b b

The method of app'ying this is to choose two different alphabets (for example, Roman and italic) and then to construct [or rather to employ, for no construction is needed] a sentence containing five times as many letters as the message you wish to convey, writing those which represent *a* in one alphabet and those which represent *b* in the other. To quote the example given by Bacon (converted into English), suppose that the message to be conveyed consists of the single word FLY. This is represented by the sentence, "Do not go till I come," written thus :

"D o n o t	g o t i l	*l* l e *o* m	e."
a a b a b.	a b a b a.	b a b b a.	
F	L	Y	

(The final *e* is superfluous.) All this Mr. Donnelly quotes from Bacon, evidently without understanding it, for *he fails to note that the whole secret of the thing lies in the two alphabets*, distinguishing the letters which represent *a* from those which represent *b*. He prints the whole cipher-sentence in small capitals, and continues his quotation thus :—"I add [says Bacon] another example of the same cipher—of the writing of anything by anything. The interior epistle for which I have selected the Spartan despatch, formerly sent in the *Scytale* : 'All is lost. Mindarus is killed. The soldiers want food. We can neither get hence nor stay longer here.' (*Perdita res. Mindarus occidit. Milites esuriunt, neque hinc nos extricare, neque hic diutius manere possumus.*) The exterior epistle taken from Cicero's first letter, and containing the Spartan despatch within it :—

"In all duty, or rather piety, towards you I satisfy everybody

except myself. Myself I never satisfy. For so great are the services which you have rendered me, that, seeing you did not rest in your endeavours on my behalf till the thing was done, I feel as if my life had lost ALL its sweetness, because I cannot do as much in this cause of yours. The occasions are these: Ammonius, the king's ambassador, openly besieges us with money, the business is carried on through the same creditors who were employed in it when you were here, &c."

Here Mr Donnelly closes his quotation and comments as follows: "I have capitalised the words *all* and *is*, supposing them to be part of the sentence, 'All is lost,' but I am not sure that I am right in doing so.* The sentence ends as above and leaves us in the dark."

Truly Mr. Donnelly is very much in the dark. To any one reading the quotation from Bacon by the light of ordinary commonsense, it is clear that the passage from Cicero's letter should be printed in two alphabets; and on referring to the original (ed. 1857-58, vol. iv, p. 445) we find that this is the case. It happens that in this edition (and doubtless in that quoted by Mr. Donnelly) the printers, instead of using Roman and italic founts, have used two different founts of italics, so that the distinction does not at once strike the unpractised eye. It becomes obvious after a moment's examination, but this Mr. Donnelly has not bestowed upon it. The passage from Cicero reads thus in Bacon (or rather is thus given by the careful translator):—"In all *duty* or *rather* piety towards *you I satisfy everybody* except *myself*. *Myself* I never *satisfy*. For *so*," &c., &c. Substitute *a* for the Roman letters and *b* for the italics, divide into fives, and apply the above key, and it will be at once clear that these 85 letters represent the 17 letters of "All is Lost. Mindarus." The reader, if he pleases, can write out the rest of the passage for himself; noting, however, that Bacon, that is, his translator, spells "endeavours" with a "u" and that the "my" in "I feel as if my life" is interpolated by Mr. Donnelly.

If the rest of Mr. Donnelly's cryptographic inspirations are as futile as the idea of "capitalising *all* and *is*," Shakespeare's laurels are pretty secure. *The man who fails to understand Bacon's explanation of a perfectly simple cipher is scarcely the guide one would choose to follow through a labyrinthine cryptogram.* If Mr. Donnelly can see through a millstone, he should surely be able to see through a crystal; yet Bacon's perfectly lucid exposition leaves him, confessedly, "in the dark." Unless his vision improves miraculously as he goes on, we fear that the world's judgment of his theory will be summed up in the word—but no; as a little exercise for Mr. Donnelly we will put it in cipher, thus:—

Chrononhotonthologos.†

AN UNDECIPHERABLE CIPHER.

By RICHARD A. PROCTOR.

CRYPTOGRAMS being in fashion, I will describe a cipher of my own invention—possibly it may have been thought of before, but not to my knowledge—which is, so far as I can see, altogether undecipherable without the key.

The correspondents first prepare a table, whereof each retains a copy, containing twenty cipher-keys, such as the following:—

17. MALIKRESTUZ—2324312412031
1 2 3 4 5 6 7 8 9 0.

All, of course, are to be different, except that under the eleven letters there are always the numbers 1, 2, 3 . . . 9, 0, and a full stop. Suppose now a message to be forwarded runs as follows—"I will start at seven on Friday morning." The successive words of this message contain 1, 4, 5, 2, 5, 2, 6, and 7 letters respectively. The letters in the 17th key-word corresponding to these numbers are respectively M, I, K, A, K, A, R, and E—which, therefore, followed by Z to indicate a full stop, must be given at the beginning of the cipher-message. The words of the message are to be dealt with as follows by means of the key-number 2324312412031. Take the word "morning"—for *m* the *first* letter write *o* the 2nd letter after *m* in the alphabet, because 2 is the *first* digit in the key-number; for *o* the *second* letter write *r*, the 3rd following letter in the alphabet, because 3 is the *second* digit in the key-number; for *r* the *third* letter, write *t*, the 2nd letter following *r* in the alphabet, because the *third* digit in the key-number is 2; and so on, writing for *n* the 4th following letter *r*; for *i* the 3rd following letter *l*; for *n* the 1st following letter *o*; and for *g* the second following letter *k*, because the 1th, 5th, 6th, and 7th digits of the key-number are respectively 4, 3, 1, and 2. Thus the word "morning" becomes altered into *ortrlok*. All the words of the message are to be dealt with in this way, which with a little practice becomes very easy, and all the cipher-words thus obtained as well as the key-letters, *mikakarez*, are to be written as one long word. The message then, thus dealt with, appears in the following form:—

17. *mikakarez:kylnpuwcvwcwuhxkqyqhukhhzortrlok.*

The interpretation is quite easy for the correspondent, though absolutely out of reach of any into whose hands the cryptogram may fall. He turns to the key-word and number opposite 17 in his list, and noting that *z* is the stop letter, recognises *mikakare* as meaning that the successive words of the message contain 1, 4, 5, 2, 5, 2, 6, and 7 letters, so he divides up the letters following the first *z* as follows—

k|ylnp|uwcvw|cw|uhxkq|qq|hukhhz|ortrlok.

He then applies to each of these cipher-words the key-number, taking the alphabet backwards as many letters from *k*, *y*, *n*, *l*, *p*, &c., as the several digits of that number require. Thus *k* gives *i*, the second letter before *k* in the alphabet; and we thus get the first word *I* of the message; the four letters of the next word must be set back in the alphabet 2, 3, 2, 4 letters, giving for *y* the letter *w*; for *l*, *i*; for *n*, *l*; and for *p*, *l*; so that from the cipher-word *ylnp*, we get the message-word *will*. Dealing in the same way with the other cipher-words, we get the full message—"I will start at seven on Friday morning."

I should like to hear of any way by which a cryptogram on this plan could be puzzled out. Here is a cryptogram on this method, which the ingenious reader will find no difficulty in reading, being first told that the 13th key-word and key-number appear in the correspondents' lists as follows:—

13. KNUZTHELOFY—2015340123 20
1 2 3 4 5 6 7 8 9 0.

The cryptogram is—

13. *noiznzyneumnphoidhgirphhrproosjvoooj.*

I wrote this in 80 seconds.

The way to write a message quickly is to deal with it as follows:—Suppose the message to be "We are prepared to act," the 13th cipher-key, given above, being employed. Write down the message thus:—

2 3 8 2 3
We are prepared to act.
20 201 20153401 20 201

Then write down 13 for the cipher-number, *aulany*, from the key-word, using the numbers 23823 written above the

* The fun of this is partly lost when the English version is followed. By sheer accident the words capitalised by Mr. Donnelly occur both in the long passage and in the real message. In the Latin the words translated "I feel as if my life had lost all its sweetness," run "*Vitam mihi esse acerbam putem*," and in the extract from Cicero the first word (*Perditæ*) of the message does not occur at all.

† Even after reading the *Gazette* article, Mr. Donnelly will probably not see his way to the interpretation of this little cryptogram. So, lest he should find some minor mare's nest in it to weary the world with, we give the solution—

Chron	onhot	onth o	log o s
a a a a b	a b b a b	b a a a b	a a b b b
B	O	S	N

message, then say *wxy*, writing down *y*; *e*, writing down *e*; *abc*, writing down *c*; *r*, writing down *r*; *ef*, writing down *f*; and so on, thus making the complete message :—

13. *mlnuyyecrfrrfudvefvocen.*

The reading is similarly managed and quite easy.

This cipher is easy to write, easy to read, and cannot be deciphered. It does not fulfil the fourth condition, which Bacon notes as involved in certain cases. A message written on this system openly proclaims itself a cipher. But so does a message written on Bacon's system; for though the matter written be perfectly innocent and natural, the use of two types at once suggests that there is more in the writing than appears on the face of it.

SIMPLE MECHANICAL TRICKS.

(*Continued from page* 179.)

IN the following trick (or experiment) the law involved is that the centre of gravity of a body tends always to seek the lowest possible position.

Provide two equal straight bars of any convenient dimensions, a roller, shaped like an ordinary rolling ruler, and another roller of the form shown at R R′ in fig. 5—*i.e.*, a double cone rather elongated. Set the bars in the positions A B and A′ B′ shown in fig. 5, the ends at A resting on the surface of a table, while the ends B and B′, thrown pretty far apart, are

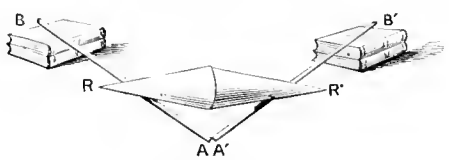


Fig. 5.

raised to such a height above the end A as to give a slight slant (two or three inches, say, in a foot) to the bars. Then set the straight roller on the slanted bars, and show that it will at once roll down to A and thence on to and upon the table—a movement which will by no means surprise the observers. Then take the double-cone roller, and making some remarks about modifying the action of gravity, set this roller on the inclined bars as in the position R R′. To the surprise of the observers, or at least of a considerable proportion of them, the roller instead of travelling down to A will seem to climb up the inclined rails, passing to B B′ and thence to the table.

You may then take up the rods and the rollers, while the spectators express their opinions upon what they have seen. After a while remark that the roller evidently climbed up the slope, out of contradiction, perhaps because the slope was too steep! Diminish the slope by taking a book from each side and set the bars again sloping from the lowered book-heaps, but taking care to set the bars this time parallel to each other, the ends A and A′ being set as far apart as the ends B and B′. Roll the straight ruler down as before, and then set the other across the bars. Those among the audience who had not been able to understand the rolling of R R′ from A A′ towards B B′ before, will see no reason why it should not roll that way as in the former experiment. But instead of this it will now roll towards A A′ just as freely as the straight roller had done.

The reason of these different movements should be obvious. When the rods are set in the position shown in the figure, the roller R R′ is really descending in moving toward B B′; for as it passes to the parts of the rods farthest apart it is supported on parts of its own surface, drawing nearer to the points of the cones, and is more lowered by this change than it would be raised, were it an ordinary straight roller, by the slight slant of the rods B A and B′ A′.

A pretty modification of this experiment may be obtained by preparing a descent beyond B B′ precisely matching the ascent from A A′ to B B′—the junction of the rods A B and A′ B′ at B and B′ with the descending rods from B and B′ to an apex like A on the further side, being close and neat. For whereas a straight roller set on either slope would pass downwards or away from B B′, the double cone roller will run up (apparently) to B B′, and then, after travelling a certain distance (the mere effect of inertia) on what looks like the downward slope, will come to rest, and, changing the direction of its motion, will pass back again over the seeming ridge line at B B′. The double cone roller will thus pass backward and forward over the top of the system of slanted rods, in apparent defiance of gravity. But in reality its centre of gravity is oscillating on either side of its lowest position.

An experiment depending on a kindred principle is illustrated in figure 6. Each represents in section: first, two stout plane boards, A B and A′ B′, hinged (or otherwise connected) at the ends A A′; secondly, two friction-rollers

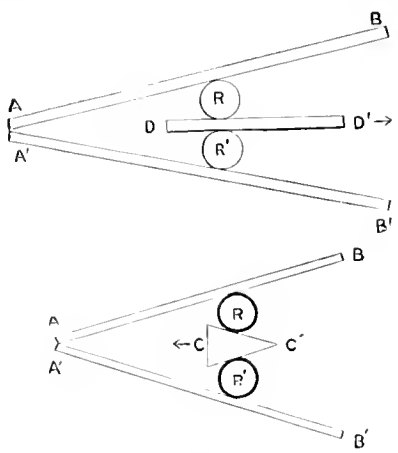


Fig. 6.

R and R′, easing the sliding of the flat board D D′ in one case, and of the wedge-shaped block C C′ in the other. In the case illustrated in fig. 6, pressing the boards A B and A′ B′ toward each other forces out the board D D′ in the direction shown by the arrow; but in the case illustrated in fig. 7, instead of the wedge C C′ being forced outwards by such pressure, it is forced inwards, as the arrow indicates, if the angle of the wedge is greater than the angle between the pressure-boards. It is easy to see the reason of this. In both cases the boards A B and A′ B′ yield to the pressure, B and B′, approaching; but whereas in one case the motion of D D′ outwards makes room for this approach, in the other the motion of C C′ outwards would bring a thicker part of the wedge between the rollers, and A B, A′ B′ would be forced more apart by this than they would be drawn together by the mere motion of the rollers outwards.

Mechanical tricks depending on inertia are often very surprising to the uninitiated. They are also very instructive. It occurs to me to notice that I was once victimised most unpleasantly by a mechanical trick of this sort played upon me by chance, not by any practical joker. I was running along a railway platform carrying a heavy valise in one hand, and a rather cumbersome but not heavy weight in the other. My foot caught against some projection in the

floor; but had I been running unweighted the accident would not have mattered in the least; in a step or two I should have recovered myself. Being loaded, however, and with weights I did not care to drop suddenly, the case was different. The inertia I had to deal with was greater, by perhaps 150 pounds, than my own. Forgetting this, and holding on to my baggage, I staggered along some twelve or fifteen paces and should have come to the ground then, had I not let my baggage go—somewhat to its detriment. It was a striking lesson in the laws of inertia.

A pretty illustration of inertia may be presented as follows:—Set up twenty draughtsmen, of the flat-faced sort, into a vertical column. Now hold a long paper-knife with one end of its horizontal face opposite the middle of one of the lowest of these flat discs, the right hand exerting a strong pressure such as would cause the knife to strike that draughtsman did not the left hand resist the pressure. Suddenly release the paper-knife so that the action of the right hand sends its end sharply against the draughtsman, striking it horizontally out of the pile. It will fly cleanly out, if the stroke is deftly delivered, and the rest of the column will remain upright, lowered only by one draughtsman's height.

Drawing a strip of paper horizontally from under a heavy coin standing on its edge, so sharply and neatly that the coin is left standing, is another pretty illustration of inertia. A crown will serve for this experiment, but the old twopenny copper piece was better.

I rather hesitate to mention that a table napkin spread on a small table as a cloth for one man's dinner can be drawn from under that dinner so deftly as to leave everything standing. For this experiment requires skill, and skill requires practice. Practising on portions of a dinner-service is apt to be expensive.

The way in which what seems a tremendous blow with a hammer can be neutralised by what seems a crushing weight is worth noticing. A man lies flat on his back and a well-filled wooden trunk or some similar weight is placed on what we conventionally agree to call his stomach. Now let a confederate seize a mallet and strike a heavy blow on the top of the trunk, a blow which delivered directly on the stomach would be fatal. The blow does no harm whatever, its force being taken up in giving a very slow and slight downward motion to the heavy weight.

A needle can be driven through a sixpence or even a shilling, if the coin is set upon a broad cork and the needle is passed into a cork set on the coin. For the needle receives the whole force of the blow along its length, and cannot break because of the side pressures produced by the cork.

A curious effect is produced if one breathes through a cone-shaped blower at a small banner hanging in front of

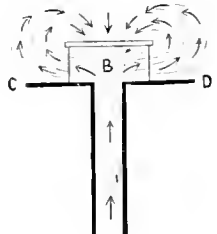


FIG. 7.

the open end. The banner waves toward the blower's mouth, not from it. If the blower be reversed so that the breath is blown in at the larger end (which, of course, must not be too large) the usual effect of blowing will take place; but in the former experiment currents of air arise, which curling outward from the rim of the larger end of the blower, cause a rarefaction of the air there, so that an indraught carrying the banner toward the blower is produced.

In like manner may be explained the fact that blowing upwards through a pipe as A B, figure 7, opening out on a flat horizontal surface, as C D, a light piece of card situate as *pp'* (kept in any convenient way at a certain distance from the orifice of the pipe) cannot be blown off, no matter how strongly the blower may force his breath through the pipe. The air blown in passes out in the direction shown by the arrows C and D, and curving round above *pp'* presses the card downwards as strongly as it is pressed upwards by such portion of the breath as reaches the under side.

The breath may be used to blow up a book—not after the *Saturday Review's* fashion, but fairly. Place a heavy book on a paper bag, like an ordinary flour bag, leaving the mouth of the bag projecting from under the book. Then blow steadily into the bag, the book will rise as the bag swells.

EVOLUTION OF LANGUAGE.

By ADA S. BALLIN.

XI.

THE Chinese language bears traces of its great antiquity in the strong evidences of phonetic decay shown by the fact of the variety of meanings rendered by one sound. There are over 40,000 distinct words, or more properly speaking, characters, in Chinese, though barely 10,000 are generally used in the various branches of literature, and not more than 3,000, perhaps, in ordinary conversation. But to pronounce these 40,000 characters there are something *under* 500 sounds, putting the tones aside; and while there are a few sounds whose distribution, so to speak, among the characters is comparatively limited, there are others which are so widely diffused as to fill us with astonishment. For example, as Mr. Fred. H. Balfour writes to me, "I once had the curiosity to search through K'ang Hsi's Dictionary for all the characters pronounced like the fifth letter of our English alphabet. I counted considerably over seven hundred, and my teacher, a Pekingese, informed me that by going further afield, the list might be made up to a thousand." *Tsen* has sixty; *le*, eighty; *chin*, a hundred; *ke*, one hundred and eighty; and *e* no less than two hundred and sixty-five different symbols attached to the one sound, and there are not only hundreds of totally distinct characters with only one monosyllabic sound among them, but one of those characters often has a large variety of totally distinct meanings. I subjoin a few examples, culled from Williams's Syllabic Dictionary.

亂 *Luan.* To bring into good order; a state of order; to confuse, to throw into disorder; to mislay; discord, confusion; insurrection, anarchy; out of place, disarranged; tumultuous; ravelled; to ferry over; the end of a song.

篇 *Poh.* Plants extended; trees appearing singly, no brushwood; grassy; thin; attenuated; subtle; a thin leaf or plate; a pellicle; poor, unfortunate; economical; light, few; to diminish; to slight, to treat coldly; suspicious of; to approach; an initial particle, ah, so; to reach or extend over; careless, inattentive to, anyhow; trifling; a curtain or screen.

子 *Tsŭ.* Anciently a child, but now confined to a son; a boy, a lad; a person; the people, in distinction from the prince; a sage, a teacher, a venerable and worthy man,

especially Confucius; to act in a filial manner as a son; to treat as a son; an heir, issue, posterity; a seed, a kernel; a term of respect, you, sir; or more familiarly a comrade; an officer; a viscount; the first of the Twelve Stems, relating to water and denoted by the rat; applied to the eleventh moon, and to the third watch from 11 P.M. to 1 A.M.; north, on the compass card; a spot; subordinate; &c., &c., &c.

當 *Tang.* What is suitable, opportune, convenient, or just; adequate to, competent; to bear, to take the responsibility; to act as, to be; equal to, to match; to make; to stand in contrast; to meet or occur; at the time of, when—in which sense it is often a form of the present participle; used as a particle, as, then, or throwing the sentence into the future tense; to decide, to manage, to mete out; to withstand, to bear against; to screen; to pawn or pledge; to consider as, reputed or looked upon as; to serve an end; instead of, as, for; to suit with; suitable, favourable; to deceive, to swindle; basis, foundation.

敬 when read *Kih*, means to respect; to beat; when read *Yoh*, it means a bright, pleasing sight, as a fine landscape.

One would naturally think that this strange phenomenon would cause great difficulties in conversation; but these are partially obviated by the introduction of the system of tones, of which there are four in the Peking Mandarin dialect, and five in the Nanking Mandarin dialect; partially by the context in which such words are placed, and partially by the fact that although Chinese is monosyllabic, a large proportion of the parts of speech are formed of two characters joined, or in apposition, of which each supplements and explains the other, the sound presenting a distinct dissyllable. As Sir Thomas Wade says: "Just as in English, if it be necessary to particularise whether by a certain sound we mean wright, write, right, or rite, we make our meaning clear by a context which shows whether the syllable uttered is that in shipwright, to write letters, right and left, or rite of baptism, so a Chinese will explain that the *ai* he is speaking of is the *ai* in *ai-ch'in*, to implore, in *ch'ên-ai*, dust, in *kao-ai*, tall and short, or in *ai-hsi*, to love; but homophony being, in his language, as much the rule as in ours it is the exception, he is very constantly obliged to fall back on this expedient." In writing this difficulty of course does not occur, the context being clear.

The Chinese affirm that in high antiquity they used knotted cords instead of letters to constitute the signs of ideas, and convey the commands of their rulers. This means of communication was afterwards succeeded by symbols, from which the present system of writing was derived. Chinese historians attribute the invention of this system to Tsang-hëe, who lived in the reign of Hwang-te, more than two thousand years before the Christian era, who from observing a constellation in the heavens, the marks on the shell of a tortoise, and the print of a horse's hoof on the ground, conceived the idea of such a method of communication through the eye, in fact a system of ideography.

The idea that the development of the present system was artificial, as suggested in the above legend, cannot be seriously entertained, it was doubtless gradually and naturally evolved from the primitive picture-writing under the law of conservation of energy, by which a single line in time comes to do service for a whole figure. Modern researches endorse the opinion of Paŭ-shí, a Chinese scholar who lived about 1100 B.C., and who stated in his work that the greater part of the Chinese characters were originally hieroglyphic; but gradually changed for the sake of appearance and convenience.

The ultimate scheme is reducible to a few simple principles:—1. *Resemblance* of the figure to the object signified; as a circle for sun, a crescent for moon and the like. 2. *Reference to some property or circumstance.* 3. *Combination of thoughts* as *truth*, a combination of the signs for *man* and *word*. 4. *Contraries* are expressed by reversing or inverting the character, and so on.

A symbol representing two men with their backs towards each other, pronounced *pih*, signifies perverse, to turn away from, retreat, and in the modern language "the north," *i.e.* the back of the world. A combination of the words for "human hair" and "changing" means *old*. A certain character is doubled to mean "to follow," and tripled to represent "many."

The whole of the Chinese language is arranged in the dictionaries under 214 roots, or radical and original characters, which enter into the composition and influence the meaning of every word in the language, which are arranged as follows by Sir J. F. Davis.*

	Classes.		Classes.
Human kind and its relations	14	Objects in early art	41
Mammalia	8	Numbers	5
Other animals	7	Actions (verbs)	37
Vegetables	13	Qualities (adjectives)	30
Minerals	5	Undefined	1
Parts of animals	28		214
Other objects in nature	25		

Analysing a dictionary containing about 11,666 words, the above-named author compiled a series of most interesting tables, showing the total number of compound words into which each root enters, from which tables it may be seen that one word may give rise to some hundreds, for example, the word meaning "to walk swiftly" enters into 145 compounds, "to speak, express," into 373, "wheel, carriage," into 127, "garment" into 184, and so on, the seven most prolific roots comprehending between them no less than 3,385 words, classed as follows:—

	Compound.		Compound.
Man	478	Tree, wood	493
Mouth	437	Grass, herbs	470
Heart	467	And water	548
Hand	492		

The word "man" combined with "one" means *alone, deserted*; with "hundred" it signifies *centurion*, with "field," *husbandman*; with "village," *rustic*; with "emperor," *noble, elevated*; with "justice," *right, correct*, and so on. The character meaning *Sin*, "the heart," which is regarded among the Chinese as the seat of the affections, emotions and intellect, combined with *hea*, "downwards," means *downhearted*, with *taou*, "a knife," *grieved*; with *urh*, "the ear," it forms *che, conscience, a sense of shame*, &c. Under the radical *che*, "hog," is classed *seang*, "an elephant," under *new*, "an ox," *se*, "a rhinoceros," under the root for "dog" come wolf, fox, ape, and lion. The roots thus serve as the generic heads of the words into the composition of which they enter.

The process of the development of abstract from concrete words, which may be compared to that of the conventional sign from the primitive picture, can be more clearly traced in Chinese than in any other language, although in all it can be shown to have gone on the same lines.

Thus, *ân*, infant, used also as "little"; in diminutives *siŭ*, a character composed of those meaning *heart* and *blood*, signifies "pity"; *yê* (roof, man, dark) "night"; the ancient character for *gān*, "peace," "tranquillity," represented a woman under a roof—sitting quiet at home. Doctrine is

* See "Chinese Miscellanies," pp. 78-82.

rule-reason, trade=buy, sell: joking=laugh, talk; dialogue=ask, answer; duty=own part; *fû*, "a father."

We also find a large number of abstract ideas expressed by the combination or apposition of more than two words. Thus our idea of *creation* is translated by "open heaven, split-earth"; *conduct* is rendered by the words for "speak, act, move, rest," or "words, ways, deeds." "The five lakes and the four seas" is their equivalent for "the world." "Food+cups" equals "feast"; "look+wait" means to visit friends. The figure for *hon*, *hân*, "cold," is made up of a man under a roof among grass, and over ice.

I have dwelt at such considerable length on the structure of the Chinese language because of the strong light it throws on the processes of the evolution of language in general; for, although the outer features of human languages, as of human faces, may differ, their physiological structure is on the same general principles, and I may be permitted, while expressing the conviction that in Chinese, as in other languages, the majority of imitative, or so-called onomatopoetic words have become unrecognisable by the process of phonetic decay, to strengthen my position by the quotation of a few imitative words now in use, which I have taken somewhat at random, and without making any particular search for them. In my article on "Demonstrative and Pronominal Roots" I gave some instances of natural and imitative sounds in Chinese. Summers, in his "Handbook of the Chinese Language," says: "Besides the ordinary interjections of surprise, admiration, &c., there are in the Chinese colloquial style a great number of expressions in imitation of the various sounds heard in nature (onomatopœia), as the *falling of water*, *jingling of crockery*, *bursts of laughter*, &c."—such is *fân-fân jing-jing*, to express the noise of business in a market-place (p. 95). Among many others I may select as examples *kiaû-kiaû*, "the crowing of a cock"; *siaû-siaû*, "the noise of wind and rain." To which examples I may add the following: *ting* signifies "nail"; *kûng*, "a bow"; *hô*, "fire"; *shwui*, "water"; *kin*, "metal"; *shí*, "an arrow," with a different character, "an omen from heaven"; *pí*, "the nose"; *ping* is ice; *p'uk*, *p'u*, to hit with the hand; *kom*, *kân*, to dare; *hân*, *kâu*, breath, obstructed effort—as of speech; *hu*, *hân*, to cry out; *ch'ui*, to blow; *küt*, *chüeh*, to hiccough; *ki*, *chi*, choked; *mâu*, the low of an ox. The sign meaning *fân*, a bird flying upwards and not coming down again, is also read *pât*, *pu*, not. *T'âu* or *p'âu* is to reject with scorn and spitting; *lân*, *lin*, to flow; *ts'âu*, *hsiu*, to swim; *fo*, *hwa*, fire; *ch'i*, the teeth.

INK *VERSUS* WRITING FLUID.

THOUGH the old-fashioned gallic ink had its faults, it was altogether superior to the "fluid writing ink" now in such common use. I know of no ink ever invented more undesirable than this last. It has great fluidity, be it granted, and this is doubtless a desirable quality. It also illustrates admirably several chemical principles, but they are not such as we desire to see illustrated when writing.

For example, it corrodes the metallic pen we are using; but it is not pleasant when, perhaps after long searching, one has found a pen which writes with absolute smoothness and neatness, to have that pen presently spoiled, even though the process by which the metal of the pen enters into chemical combination with the acid of the ink be scientifically interesting. (I am myself, like most rapid writers, rather hard to please in the matter of pens.)

Again, the fluid ink writes light though the writing presently turns dark, owing to a chemical change of considerable interest; but every literary man likes his writing to be dark from the start. An even worse fault of the truly hateful compound called writing fluid is that if you pause to think (a process considered occasionally allowable even among literary men, but which the inventor of the fluid evidently failed to take into account), the chemical process by which your pen is being destroyed takes place so effectively as to transform the green fluid into a sickly yellow, which does not turn black after writing. You are obliged to take a fresh supply of the fluid on your nib, if you would not have several words of your writing of the colour which our Irish friends poetically term "dunducketty mud colour." (To be scientifically accurate you ought to dry the pen before taking this fresh supply.)

Yet again, the fluid ink is so undesirably fluid that manuscript written with it is bound to be plentifully smeared; for the ink is ready to smear long after any reasonable ink would be dry.

The fluid ink seems to have been invented solely in the interests of the makers of steel pens; for while, in the first place, it cannot be used with quill pens, since the chemical changes on which its ultimate blackness depends require the iron of the pen, it so rapidly destroys steel pens that one must use at least three times as many as one would require with good ink.

The old-fashioned ink could be used to produce the best dead black colour known to me. (The discovery is original with me, so far as I know.) You take black French chalk—the usual crayon chalk—and score over with it the surface you wish to blacken, paying no special attention to uniformity, and leaving all the chalk dust on the sheet. Then with a brushful of the old-fashioned gallic ink (or you may use a feather) you go over the surface thus roughly blackened, and forthwith find that a beautifully uniform black is produced, which on drying is a fit surface for drawing on with coloured or white chalk. It is especially desirable for pictures of nebulæ, comets, and other such objects.

It is essential when ink is used for written records, if such records are to be safe, that the ink should resist all such chemical processes as reverse the changes considered above, turning coloured into colourless matter. It is well known that the old-fashioned ink yields to several chemical agents. If advantage were only taken of this to remove ink-stains where ink-stains are not desirable, this would be a gain rather than a defect. But records of various kinds may be treated with chemicals till the ink disappears, with results altogether undesirable. A solution of oxalic acid, or of hydrochloric acid, will act as an effectual bleacher in the case of all ordinary inks, the acid of the solution entering into combination with the metallic colouring material of the ink, leaving one colourless liquid and producing another. If the ink-marks thus removed be records relating to property, signatures to deeds, the filling-in of cheques or the like, the results of such chemical experiments are by no means such that the persons chiefly interested in them can regard them as pleasing. They will, however, continue to be performed until or unless the inks used for such purposes be absolutely indelible.

Now, it will probably have been noticed by many that the printed matter is not affected at all by the agents which remove ink-stains. The reason of course is that the ink used by printers owes its blackness to lampblack, which is almost pure carbon, carbon being of all elements the one which most stubbornly resists the attacks of the agents usually most effective in producing chemical change. We recognise here the true principles on which ink for written records should be prepared. The base should be carbon-

aceous, such other substances only being combined with the carbon as will give it a hold on the paper, without which of course the ink might be simply washed off. This hold on the paper should be such in some cases (as for cheapness, &c.) that the written matter cannot be removed by any mechanical means without destroying the paper itself. I find that among the Kosmian inks the requirements of indelibility and suitable hold on the paper to prevent mechanical removal are admirably provided for, and, from experiments I have made on this ink, I infer that it is essentially a carbon ink.

SIR WM. HERSCHEL'S SURVEYS OF THE HEAVENS.

DURING the interesting discussions respecting the temporary star in the Andromeda nebula, the misapprehensions which prevail in regard to the magnificent work of the Herschels, and especially of the elder Herschel, were very prominent. Darwin has been wildly and widely misunderstood: insomuch that most men imagine his theory (and Wallace's) merely another form of Lamarck's, that he believed in evolution towards perfection, that according to him each race has descended from a pair of its own kind, and that he regarded apes closely resembling some now existent anthropoids as the ancestors of the human race. And those who thus misunderstood Darwin are hard to convince: they will not believe, when science assures them that Darwin's theory was accepted by men who had utterly rejected Lamarck's, that he recognised evolution as often tending to deterioration rather than to improvement, that the descent of any race from a pair is absurdly inconsistent with the doctrine of natural selection, and lastly, that, as regards the period when man and the present anthropoid apes diverged, the Darwinian theory would indicate ancestors at least as like man as like any existent ape, and probably much more like—for the simple reason that man has descended directly from that ancestry, while the existent anthropoids have shared descent from it with descent from contemporaries of lower race. But, preposterous as have been the mistakes made about Darwin's doctrines, they can hardly be compared with those into which even many men of science and astronomers have fallen respecting the labours of Sir William Herschel. He was an observer of the heavens for more than forty years, during all which time his active mind was busily engaged applying various methods of inquiry, inventing new ones, and testing old ones; yet many seem to imagine that at the end of his long series of labours he stood in the precise position which he had occupied at the beginning. They quote an opinion expressed during the last ten years of his work, and an idea suggested thirty years before, in one and the same chapter, nay, in the same paragraph, and even in the same sentence. Or, which is not less incorrect, though not so obviously absurd, they point to a result which he had obtained from one series of observations and had interpreted on one particular principle, as establishing such and such a conclusion when interpreted on another assumption—this assumption having been adopted indeed by Herschel at one part of his labours, but long given up when he had adopted the principle by which he had explained that result.

It is not commonly known, even though on this point the whole value of Herschel's labours in reality depends, that he employed two entirely different methods for gauging the star depths. One would imagine that they must have been so similar as to be easily confounded together, seeing that (except the present writer) only one student of astronomy, the late W. Struve, has ever insisted on the distinction between them. Even W. Struve, in his justly celebrated (but little read) "Études d'Astronomie Stellaire," failed to notice how inadequately Herschel had been able to test the second method, his career as an observer having come to a close less than four years after he had devised it. In reality, however, these methods, which Arago, Humboldt, and other men of note, as well as hundreds of the mere astronomical compilers, have confounded together, presented the following points of rather strong contrast:—

Herschel's first gauging method depended on turning one powerful telescope to different parts of the stellar heavens in succession; his second method depended on turning many telescopes (ranging in power from his smallest to his largest) successively to one and the same star-groupings. The first depended on the assumed power of penetrating in all directions to the outermost limits of the galaxy; the other depended on the observed fact that in many directions the galaxy is unfathomable. In applying the first method Herschel counted the number of stars in each field of view, and judged the depth of the system to be proportional to the number so counted; in applying the other he did not count the stars at all, but noticed only how much of each field was cleared by the space-delving power of each of the telescopes successively employed. (One may say that in one method he counted stars, in the other he counted telescopes.) The former method depended on the assumption that the wealth of stars in the Milky Way resulted from the enormous length of the range of view through regions occupied by stars uniformly strewn; the second had been devised because, in his own words, he had "found after a long inspection and examination that the stars in the Milky Way are arranged very differently from those in our neighbourhood." Lastly, the first method was subjected to more than thirty years' testing before its fundamental assumption was thus recognised as erroneous; the second method was tried only for about three years, and the results accumulated during that time were never employed to test the validity of the primary assumption, but presented only as indicating such and such conclusions *if* the initial assumption were trustworthy.

That two methods so utterly unlike, nay, so opposite, in plan, purpose, and principle, requiring such different methods of observation, and so different in their history, should have been confounded together, would be amazing were it not that men are so much readier to accept plain statements as to facts than to analyse either preliminary explanations or subsequent reflections. If Herschel, interpreting his earlier gauges by his first assumption, said that the galaxy extends ten times farther towards the Milky Way than towards the regions with black background—there is a simple fact to be quoted; let it be entered in our note-book. If he found, interpreting his later gauges on his second assumption, that the Milky Way is in many places unfathomable—*that* is not only a simple but an impressive statement; by all means put that down too. It may not seem consistent with the former; but both statements were made by Herschel; both appear (with only a trifling interval of thirty years or so between them) in the "Proceedings of the Royal Society": there can be no objection to their being used in the same paragraph, or even the same sentence. Herschel could not analyse the outermost parts of our galaxy, therefore they are hundreds of years' light-journey away; it would be a pity to omit *that*. And he considered the nebula in Andromeda very near (on the principle of his second gauging method), because his smallest telescope, nay, even the naked eye, shows its milky

light—*that* also must be mentioned. The nebulæ he could resolve into stars Herschel regarded as near; the Andromeda nebula, which he could not so resolve, he considered, so judged, to be much farther away. This result, being inconsistent with the other, might be supposed to suggest doubt whether we must not give up either the principle of inferring distance from the telescopic power required to show an object, or else the principle which depends on the power necessary to resolve an object into stars; for the Andromeda nebula cannot be at once the nearest of the nebulæ, as Herschel inferred when using one principle, and one of the farthest, as another principle which he had suggested would obviously teach. This, however, has by no means happened. Both principles are blandly quoted, not only in text-books of astronomy, but by astronomers who do not write text-books. Except by the present writer, and earlier (but independently) by Mr. Herbert Spencer, the obvious—one might almost say the staring—discrepancies between the results given by the two methods of star-gauging have not been noticed. Sir John Herschel, however, noticed even earlier the simply decisive evidence given by the Magellanic Clouds, and pointed out that this evidence threw doubt on the results commonly quoted as established by his father. Doubts, indeed! Clouds, looking like rounded masses of milky light, contain stars of all orders, from the seventh magnitude, down to the faintest which even a two-feet mirror will show, and patches of absolutely unfathomable nebulosity, besides all classes of nebulæ; so that these clouds, interpreted by the two methods of star-gauging, consist of series of marvellously attenuated spike-shaped regions of stars—the spikes all, by a strange chance, pointing directly from the solar system, while also these spikes, really belonging to our own sidereal system, all point directly towards remote galaxies lying at distances exceeding thousands of times the whole span of our galaxy. This is not merely incredible, it is impossible; for such spike-shaped arrays of stars could not remain in that preposterous form, even if they could assume it for a single day.

It has been only through the careless commingling of Sir W. Herschel's varied results and methods that absurdities such as these have been associated with his splendid labours, and it has only been by entirely misinterpreting the immense mass of material he has collected, and applying remarks made at one time to results noted at another when his views had entirely altered, that the idea of objects thousands of years of light-journey from our system has come to be regarded as anything beyond a mere speculation. It only appears in Herschel's papers in company with an assumption which has long since been entirely disproved.

Gossip.

By RICHARD A. PROCTOR.

THERE is no room this month for the Chart of Mars, which is now, however, in the engraver's hands, and will appear next month.

* * *

THE series of papers on Spectroscopic Analysis promised for the present volume has been delayed chiefly by want of space. We have had to find room for several matters which had not been taken into account or looked for. I may note here that papers on spectroscopic analysis, considered as it has to be considered in text-books, would have no value here. Only such matters will be considered as are usually left untouched in such books. In particular, the laws on which the formation of the diffraction spectrum depend will be carefully dealt with. This matter has been either wholly neglected in the text-books, or such explanations have been given as scarcely any fellow not a fellow of a mathematical society could be expected to understand or follow.

* * *

A CORRESPONDENT invites me to write a series of articles with illustrations showing how the constellations appear to the inhabitants of planets attending on other suns than ours. I can very readily state and illustrate all I know, or could by life-long labour learn, on this portentous subject. Omitting three stars, all I know about it is indicated between the end of this paragraph and the beginning of the next.

* * *

IN KNOWLEDGE for May last there occurs, in one of the short reviews, an expression relating to the last Government for which I deem it just to offer apology. The author of the review must not be understood therefore as necessarily considering that any apology is necessary on his behalf. It is solely for myself, as conductor of KNOWLEDGE, that I speak. I offer no opinion about the late Government or about the particular matter on account of which an expression belonging too clearly to the vocabulary of abuse (so Bob Acres thought, anyway) is applied to that Government. I only note that KNOWLEDGE must not deal with politics, save as they bear on sociology, which is a department of science. It has always seemed to me unfortunate (sociologically speaking) when newspapers (even partisan organs) substitute personal attack for the discussion of the principles on which the conduct of political matters should depend. I reside in a country where the great body of the people seem to expect their newspaper writers to be virulent; but the better sort, even here, do not like to see personal attacks in the daily journals. I should be sorry to see our newspaper writers in the old country "letting their angry passions rise" and their tone sink, as happened I fear (I hear so) during a recent struggle into which somehow Donnybrook Fair fashions (perhaps naturally) found their way for awhile both in Parliament and in the papers.

Reviews.

Practical Education. By CHARLES G. LELAND. (Whittaker & Co.)—We owe a good many bad things to commercial competition, and some good things; and among these last, perhaps, may be classed the demand of late years for practical education. Granted that a boy must have his mind sharpened upon some whetstone, is a Latin whetstone the only one that will suit? Allowing that there are certain things which must be learnt while a boy is at school (as, for example, the elements of literature), may no seeds be planted to develop later that may bear actually on his future work, and fit him earlier for the battle of life? Our English education has been one-sided far too long. *Aut Cæsar aut nullus* may be freely translated for our public schoolboys "either a classic or a duffer;" and our modern sides have generally been the intellectual dustholes of the schools. "Rubbish may be shot here" would be a suitable motto for the doorways to the classrooms, and all who enter abandon hope of success in their school life. But the times are changing, and Mr. Leland's book is a valuable contribution to the discussion of an important question. Mr. Leland may say *credo experto*, for his plans have been tested and found successful. As a supplementary course to their ordinary school-work, his pupils pursue many light, interesting, and useful arts as carpentering, leather-work, carving, *repoussé* work, and so forth. These have as their

basis a training in design, and even if Mr. Leland's pupils never get beyond admiring artistic effects, and striving to imitate and originate them, it would be a great thing. But he claims that they have been eminently successful; and while we do not quite like the occasional reference (as if it proved the writer's case up to the hilt) to the fact that "such a pupil could easily earn two dollars a day," his plans are, we think, very good. The Sloyd or Slöjd system of manual instruction to which Mr. Leland alludes in his preface, and of which, we think, he should have known earlier, hardly competes with his method. It might even be dovetailed in with it, as an elementary branch. In giving its pupils a model to follow strictly, and leaving no room for imagination or design, it is decidedly inferior to the plans pursued by our author. In the chapters on memory Mr. Leland has dealt with the decay of this power under the influence of printed books. But we think that here he unduly estimates the powers of the ancients; probably an educated man nowadays, knowing some one thing well, the elements of numerous subjects, and where to look for details, *remembers* a great deal more than the average educated man of centuries back. The marvellous stories told by Mr. Leland as to feats of memory we are bold enough to doubt. The book is, however, readable and well worth reading.

Electrical Instrument Making for Amateurs. By S. R. Bottone. (London: Whittaker & Co. 1888.)—We may fairly say that Mr. Bottone has produced the very model of what a practical handbook should be. On the value and advantage to the amateur of being able to construct his own apparatus it is needless here to insist, and the pupil who places himself in our author's hands must be incredibly idle and inattentive or abnormally stupid should he fail to produce satisfactory results after a study of the little book before us. The descriptive language is of the plainest, and an abundance of woodcuts suffices to make everything needing illustration clear and intelligible. Every student of electrical science should purchase Mr. Bottone's small work straightway.

The Pattern-maker's Handybook. By Paul N. Hasluck, A.I.M.E. (London: Crosby Lockwood & Son. 1887.)—Castings in iron, brass, and other fusible metals are made, as many who will read these lines know, from wooden patterns which are imbedded in what is called moulding sand, on their withdrawal from which hollow moulds are left into which the molten metal is poured. Very great art and nicety indeed are involved in the construction of these patterns, as, to take a single illustration, if the lower part of the model were in the least degree larger than the upper portion, it never could be extracted from the sand at all without breaking such sand down. Mr. Hasluck's book, then, goes into the details of construction at once of the simplest as of the most complicated patterns likely to be met with in practice. It forms a most valuable, if not indispensable adjunct to Mr. Graham's "Brassfounder's Manual."

The Gospel in Nature. By Henry C. McCook, D.D. (London: Hodder & Stoughton. 1888.)—Eloquent in diction, and replete with a wealth of illustration, these sermons of Dr. McCook's seem admirably adapted to carry conviction to the minds of—those who believe already! For through the entire book runs the most obvious *petitio principii* that every word of the Bible, as we have it, is supernaturally free from error, and that the myths and legends of the earlier books in it are as irrefragable history as a report in "Hansard" is of a debate in the House of Commons. We need go no further than our author's illustration drawn (on p. 80) from the battle of Beth-horon, although we are thankful to say that he stops short at the hail and thunderstorm, and does not inflict the story of the sun and moon standing still on his readers. How much of their history (so called) the Jews derived from the Chaldæans we are only just beginning to apprehend. But the point upon which we would particularly insist is that the very natural phenomena which he adduces in proof of the harmony between science and revelation might be quite as justifiably employed by the Parsee to show the divine origin of the Zend-Avesta, or by the Brahman to prove that the Vedas were inspired. It seems like killing the slain to point out that (on p. 113) he refurbishes Paley's exploded argument, that any one seeing a clock (it was a watch in Paley) must perforce be convinced that that clock had a designer; ignoring the fact that such supposition would only occur to a person who had previously seen a piece of mechanism of some sort in the course of construction. Did Dr. McCook never hear of the Highland soldier, who, having robbed the body of a dead officer of his watch at Prestonpans, and being absolutely ignorant that it required winding up, gleefully sold it next day for eighteenpence, as (he subsequently told his comrade) "she had died in the night"? Millions of men have seen various pieces of machinery made, or are familiar with those who make them; but we have, so far, never yet met with a man who has witnessed the construction of an echinus or a giraffe. Be it remarked that we are neither denying nor asserting that marks of design are visible in nature; we are only predicating the utter failure of Dr. McCook's illustration to prove it. People, though, who care for sermons, and who require something above the level of ordinary pulpit platitudes, may do worse than obtain the volume before us.

The Religious Sentiments of the Human Mind. By Daniel Greenleaf Thompson. (London: Longmans, Green, & Co. 1888.)—So comparatively large a proportion of mankind take their religion from their priest or minister, as they do their physic from their doctor, that to speak of a science of religion must appear to them as something akin to blasphemy. Their mental attitude is scarcely caricatured in the more or less veracious narrative of the small child in the Sunday-school, who, when asked what faith was, replied, "Believing what you know isn't true!" And yet a little dispassionate reflection must suffice to convince any impartial thinker that the religious sentiment, like any other mental affection or operation, must have its origin in the constitution of the human mind, and must be as amenable to investigation as any other psychical condition, whether perceptive, intellectual, volitional, or emotional. In the very able and thoughtful work before us, then, Mr. Thompson traces the genesis of the idea of the supernatural, and exhibits, in more or less detail, the forms in which it has subsequently been developed: the ultimate conclusion at which he arrives being that while we really *know*, and can know, nothing of the matter in any legitimate sense, yet that the balance of probability inclines towards the existence of the supernatural, and of, in some form, a future life. He then discusses our religious sentiments in relation to feeling and conduct; incidentally treating of the various conditions of existence in another world which have been imagined by divers schools of thinkers. In the concluding portion of his remarkable volume he deals with the application of the principles he has enunciated to popular education, and here makes a suggestion which will assuredly set by the ears the thousand and one sects who figure in every census. It is neither more nor less than this, that no dogmatic theology should form any part whatever of the curriculum of public education, but that if religion is to enter at all into such curriculum, the students should be carefully instructed in the arguments against as well as those for each and every

form of religious belief—leaving him or her to decide between them. That, in the existing condition of the theological world, this idea must remain a purely Utopian one, no one familiar with the intense sectarian bitterness prevailing there can for an instant doubt. The eagerness with which the clergy of one persuasion expose the artifices of those of another was the subject of comment by Buckle long ago, but to suppose, for example, that an upholder of the Athanasian Creed will consent to the presentation of that remarkable confession of faith side by side with the Unitarian (to say nothing of the scientific) arguments against it, is to imagine that human nature will change *per saltum*, or like a conjuring trick. The present intellectual attitude of every professor of the myriad forms of "faith" with which the world is afflicted, from the Churchman down to the Shaker, is embodied in words used to the writer by one of the most ignorant young men among all his acquaintance, "Other people only believe that they are right, but I know that I am;" and as long as this deplorable mental attitude persists, any advance in the direction so ably advocated by our author is hopeless.

A Treatise on Electricity and Magnetism. By E. MASCART and J. JOUBERT. Translated by E. ATKINSON, Ph.D., F.C.S. Vol. II. (London: Thos. De la Rue & Co. 1888.)—This second volume of the great work of MM. Mascart and Joubert is devoted to the methods of electrical measurement, and to the applications of electricity and magnetism. It treats the whole subject exhaustively, both mathematically and experimentally, and is a book without which the library of the advanced electrician is distinctly incomplete.

The Long White Mountain: a Journey in Manchuria. By H. E. M. JAMES. (London: Longmans, Green, & Co. 1888.)—The geographer, the ethnologist, the historian, the theologian, and the politician, alike with him who reads merely for amusement, will find a fund of matter for thought in Mr. James's interesting, important, and very readable volume. In these days, when books of travel are compiled by so many who simply take a return ticket to the United States by a Cunard steamer, or who go a little off the beaten track in the Tyrol, it is positively refreshing to sit down to the perusal of a narrative of the exploration of a country practically wholly unknown to Europeans, related in the manly and straightforward way in which Mr. James tells his story. A Bombay civilian, he became entitled in the winter of 1885 to two years' furlough, and in company with Lieutenant Younghusband, of the King's Dragoon Guards, he determined to devote a portion of his leave to a journey through Manchuria. A glance at a map of Asia will show that this forms the north-eastern portion of the Chinese Empire, being conterminous with the Russian dominions on the north and east, and with the Corea on the south. Its area is approximately 180,000 square miles, and our author estimates its population as between 20,000,000 and 23,000,000. The reigning Chinese dynasty had its origin in one of the three provinces (Fêng-t'ien) into which Manchuria is divided. So utterly ignorant have Europeans hitherto been of Manchurian geography that, in a map issued not long since by the Royal Geographical Society, a chain of snow-covered mountains some 12,000 feet high appears which has no objective existence whatever! In the southern and eastern part of this strange country, though, "The Long White Mountains"—which give their name to the work before us—are actually to be found, and very grand must be the landscapes in which they form a prominent feature. A facsimile of a coloured sketch by Mr. Younghusband of the so-called "Dragon's Pool" at the very summit of the range forms an appropriate frontispiece to the volume. At a place called Yingtzu, on their way from Newchwang to Moukden, our travellers were joined by Mr. Fulford, of the Consular Service, who as a good linguist and first-class shot formed a valuable addition to the party. We do not propose to follow them here through their long journey of something like 3,114 miles in unknown regions, a journey often performed under circumstances of difficulty and peril well calculated to have deterred men of merely average resolution and pluck altogether. The reader will thank us for sending him to gather the details from Mr. James's book itself. We need merely say here that its perusal will throw fresh and valuable light upon the condition of the Chinese empire, and on the nature of its relations with Great Britain. Some additional insight into Russian policy in Asia may also be obtained from its pages. A good idea, too, will be gathered of the kind and amount of success attained by the various missionaries—Catholic and Protestant—who are making so heroic a fight for their own forms of faith in these remote regions. Finally, we earnestly recommend every impartial inquirer to study carefully our author's utterances on the opium question, concerning which as much utter cant has appeared in this country as has ever been written or spoken even about total abstinence or vegetarianism itself. An excellent map and an exhaustive index add materially to the value of Mr. James's volume, which we have no hesitation in pronouncing *the* book of travels of the season.

The Naturalist in Nicaragua. By THOMAS BELT, F.G.S. Second edition, revised and corrected. (London: Edward Bampus.)—We heartily welcome this reprint of one of the most fascinating and instructive narratives of travel ever published, for the first edition is not only out of print, but very scarce. Apart from the vivid descriptions of Central American scenery which brighten its pages, it evidences throughout to the powers of minute observation, and of insight into the deep significance of the actions of the humbler life-forms, especially of ants, which its lamented author possessed, and which won for his work Darwin's unstinted praise. That "hall-mark" should suffice as inducement to our readers to buy the book. The excellent woodcuts, which were a feature of the first edition, have lost none of their freshness.

The Demon of Dyspepsia. By ADOLPHUS E. BRIDGER, B.A., M.D., &c. (London: Swan Sonnenschein, Lowrey, & Co. 1888.)—Under this somewhat affected title, Dr. Bridger has produced a work of sterling value and use, and one which may be read with pleasure and profit alike by the dyspeptic and by the happy man possessing the ostrich-like power of "digesting a tenpenny nail." Our author enters very fully indeed into the nature of perfect digestion, the value of various kinds of food, and the results, primary, secondary, and tertiary, of deranged digestive powers. To read his chapters on "Vegetarianism" and "Stimulants and Stimulation" after the perusal of the rant of the Allinsons and Wilfrid Lawsons is akin to turning from an essay by a flat-earth man like Mr. John Hamplen to Sir John Herschel's "Outlines of Astronomy."

The Farmer's Friends and Foes. By THEODORE WOOD, F.E.S. (London: Swan Sonnenschein, Lowrey, & Co. 1888.)—Mr. Wood will be remembered as the author of that well-written and interesting little book "Our Insect Allies," and we may say in the outset that the qualities which rendered that work at once so valuable and readable are possessed in a high degree by the volume before us. It is one which should be in the possession of every agriculturist: farmers, as a rule, having but indistinct ideas as to what forms of animal life it will best pay them to preserve. The two solitary birds whose presence on a farm Mr. Wood regards as an unmixed evil are the wood-pigeon and the bullfinch, while he has a good word—in point of fact a great

many good words—for that pariah among the feathered tribes, the sparrow. Many will learn with some astonishment how much they are indebted to the frog, the toad, the lady-bird, and the glow-worm, among other unsuspected benefactors. Even apart from its mere economic value, the work whose title heads this notice will furnish a fund of interest and amusement to every dweller in the country by its descriptions, at once accurate and picturesque, of the myriad forms of life which either benefit or injure us. It is worthy of note, by the way, that some of the farmer's friends are bitter foes to the horticulturist; but Mr. Wood always candidly warns us when this is the case.

Messrs. Cassell & Co. send us copies of their admirable *New Standard Drawing Copies*, prepared to meet the latest requirements of the Science and Art Department; and of the "Sixtieth Thousand" of the *Citizen Reader*, describing in clear and attractive style the machinery and institutions of the State. *Hazell's Annual Cyclopædia* improves by experience, and there are few holes to be picked in this year's issue. It has become an indispensable companion to Whitaker.

Messrs. Griffith & Farran send us a compendious *Every Day Dictionary*, and the second and cheaper edition of M. Chaplin-Ayrton's *Child-Life in Japan and Japanese Child-Stories*, a delightful book, quaintly illustrated by native artists. Messrs. Hamilton, Adams, & Co. have issued an abridged edition of the ever-readable but now little-read *Noctes Ambrosianæ*, with which we advise a generation that knew not "Christopher North" to make acquaintance. Among serials we have the *Century*, with Matthew Arnold's posthumous paper on Milton; *Longman's Magazine*, with a moderate and useful paper by Dr. Richardson in favour of vegetable diet; and the *Westminster Review*, which improves every month—the May number is far and away the best among the half-crown magazines. Among the articles of sterling value are those on tramps of the past and present; England, or rather London, in the last century, as seen through French and German eyes; and a painful but valuable paper, quite remarkable of its kind, on the cure of habitual drunkards, by one who thus signs himself, and who tells the story of his shame and ultimate rescue. Space does not permit us to do more than make bare reference to an article in the *Edinburgh Review* for April on "Darwin's Life and Letters," in which the reviewer glories in his shame that he has always opposed the theory of natural selection.

Our Whist Column.

By "Five of Clubs."

THE following game, played in Sydney on March 10, 1888, was contributed by Y to the *Australasian*, whose whist editor has kindly sent it to us. We give his notes first; and some comments of our own afterwards. (Z was a visitor from England, the rest were Sydney whist-players.

THE HANDS.

B { S. (*trumps*).—Kn. H.—10, 6, 5. / D.—Q, Kn, 6, 4. C.—9, 8, 7, 4, 2. }

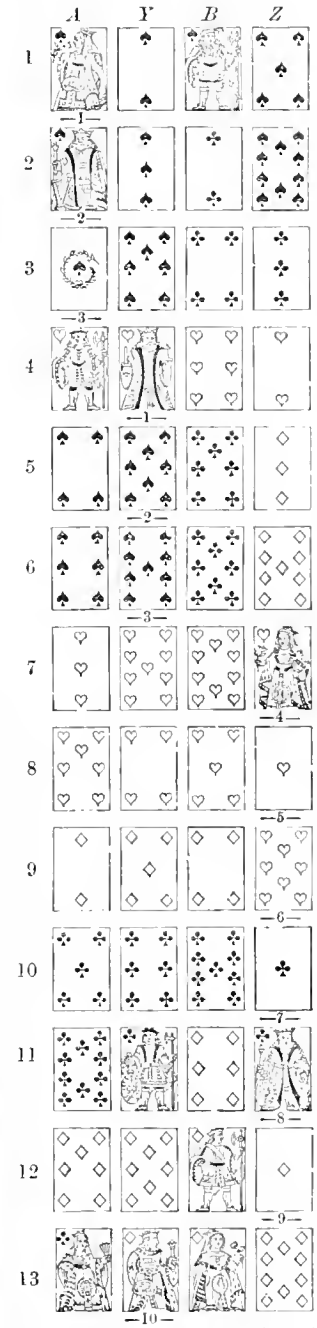
Y { S. (*tps*).—9, 8, 7, 3, 2 / D.—Kn, 8, 5. / H.—K, 9, 4. / C.—Kn, 6. } *Z* { S. (*tps*).—10, 5. / D.—A, 10, 9, 3. / H.—A, Q, 8, 2. / C.—A, K, 3. }

B / Y Z / *Tr.* S. 10 / A leads.

A { S. (*trumps*).—A, K, Q, 6, 4. H.—Kn, 7, 3. / D.—7, 2. C.—Q, 10, 5. }

Score:—A B 1; Y Z 1.

Card underlined wins trick; card underneath leads next.



And Y-Z score four by cards and a double against four by honours.

NOTES.

Trick 1.—A leads correctly. With the exception of the Club Queen he holds no card outside trump which he is likely to make. He must, therefore, trust to finding his partner with some strength in the plain suits.

Trick 2.—This trick gives A the information that there are three trumps remaining in Y's hand. B's discard ought to have been the Heart, in which he has no strength whatever, rather than the Club, which, with the help of his partner, he has some chance of bringing in.

Trick 3.—A's lead of the Spade Ace is very injudicious play. By parting with that card he practically incapacitates himself from taking any further share in the direction of the game. He ought, in our opinion, to have played the Diamond Seven, on the chance of making one of his small trumps on the Diamond suit.

Trick 4.—Of course Y makes a bid for this trick, in order to have the opportunity of drawing A's losing trumps.

Trick 10.—At this point of the hand Z has two chances of winning the game. These are that the Diamond King is with Y, in which case it is quite immaterial how Z leads; or else that the Diamond King is with A, and the Diamond Queen with Y. It is better, of course, to take advantage of a double chance than to adopt the line of play which cannot succeed unless one named card be in partner's hand. Consequently, Z ought to have led the Diamond Ten.

NOTES BY "FIVE OF CLUBS."

Trick 3.—Had not B mistakenly discarded a Club, indicating weakness in the suit, A might have led a small Club here, on the chance of making the Queen. Leading a Diamond there is rather more risk of Y's getting a lead and forcing out trumps. A single trick by A-B saves and makes the game—this is patent to the whole table; and it is absolutely essential to A-B to play as dark as possible. Heart Knave or Diamond Seven would at once indicate A's position. This applies to A's lead at trick 4, after his mistake in leading the Trump Ace.

Trick 8.—Z's play should be the Diamond Ten here, rather than at trick 10, though certainly at 10 if not made at 8 or 9. The reason for this lead is that given in the above notes.

M. Ludovici's Art School for Lady Students.—An interesting annual prize competition has been started in connection with this school, for the best subject picture. Three money prizes and three orders of merit in gold, silver, and bronze will be given. The awards will be made in October 1888, the judges being Messrs. Albert Moore, Mortimer Menpes, and G. H. Broughton, A.R.A. Messrs. Dowdeswell & Dowdeswell have kindly consented to lend their gallery in Bond Street for the public exhibition of the competitive paintings. As M. Ludovici has some very promising lady students, this competition is looked forward to with considerable interest.

THE FACE OF THE SKY FOR JULY.

By F.R.A.S.

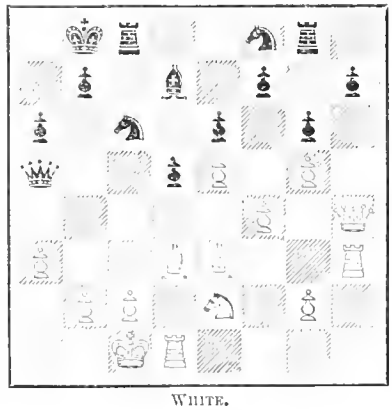
NO minute and rare are the spots on the sun's disc that they are not worth looking for. For the first three weeks there is no real night in any part of the British Islands. The face of the night sky will be found delineated on map vii. of "The Stars in their Seasons." Mercury is practically invisible at the beginning of the month, but becomes a morning star after the 9th, and on the 29th attains his greatest elongation west of the sun (19° 27'); at the end of July he may be seen before sunrise in the ENE. Venus is, to all intents and purposes, invisible. Mars is dwindling to a mere big red star. When viewed in a sufficiently powerful telescope it will be seen that his disc is gibbous and not circular; but very little of his superficial detail can be made out. He is a little to the north-west of Spica Virginis ("The Stars in their Seasons," map v.). Jupiter must be looked for as close to the meridian as possible, as he is very low down even at his transit. He is to the WNW. of λ Libræ ("The Stars in their Seasons," map vi.). The certainly visible phenomena of his satellites are very few. On the 1st, satellite ii. will be eclipsed at 10h. 57m. 27s. P.M. On the 2nd, satellite i. will enter on to the planet's disc at 9h. 30m. P.M.; followed by its shadow at 10h. 24m.; and will leave Jupiter's opposite limb at 11h. 43m. P.M. On the 3rd, satellite i. will reappear from eclipse at 9h. 52m. 25s. P.M. On the 6th, the egress of the shadow of satellite iii. will occur at 10h. 53m. P.M. On the 9th, satellite i. will begin its transit at 11h. 19m. P.M. On the 13th, the egress of satellite iii. will happen at 10h. 34m. P.M. On the 17th, satellite i. will be occulted at 10h. 25m.; and the egress of the shadow of satellite ii. take place at 11h. 5m. P.M. On the 18th, the egress of satellite i. at 9h. 49m. will be followed by that of its shadow at 10h. 56m. P.M. Lastly, on the 25th, satellite i. will begin its transit at 9h. 27m. P.M. Saturn and Neptune have both left us until almost the beginning of winter. Uranus may be picked up as soon as ever it is dark enough a little to the south of a line joining γ and θ Virginis ("The Stars in their Seasons," map v.). The moon enters her last quarter at 3h. 52·6m. in the early morning of the 1st, and is new at 6h. 6·7m. A.M. on the 9th. She enters her first quarter at 0h. 12·9m. P.M. on the 16th, is full at 5h. 45·1m. A.M. on the 23rd, and enters her last quarter for the second time this month at 8h. 29·6m. P.M. on the 30th. There will be a total eclipse of the moon in the early morning of the 23rd, but very little of it will be visible in this country, as the first contact with the earth's shadow occurs at 3h. 55m. A.M. and the moon sets at Greenwich at 4h. 10m. Seven occultations of fixed stars by the moon occur at more or less convenient hours for the observer during the present month. They are as follows:—On the 17th ξ¹ Libræ, a star of the 6th magnitude, will disappear at the moon's dark limb, at 7h. 22m. P.M., at an angle of 145° from her vertex, reappearing at 7h. 40m. at her bright limb at an angle of 176° from her vertex. On the 18th θ Libræ, a 4½ magnitude star, will disappear at the dark limb of the moon, at 9h. 2m. P.M., at an angle of 8° from her vertex. It will reappear at her bright limb, at 9h. 23m. P.M., at a vertical angle of 339°. On the 19th B.A.C. 5,700, of the 6½ magnitude, will disappear at the dark limb, at 10h. 26m. P.M., at an angle of 142° from the vertex of the moon, reappearing at her bright limb, at 11h. 14m. P.M., at an angle of 232° from her vertex. On the 21st o Sagitarii, a star of the 4th magnitude, will disappear at the dark limb of the moon 42 minutes after midnight, at an angle of 173° from her vertex; and reappear at her bright limb at 1h. 15m. the next morning at an angle from her vertex of 235°. On the 23rd, 20 Capricorni, a 6th magnitude star, will disappear at the bright limb at 9h.35m. P.M., at an angle of 64° from the vertex of the moon. It will reappear at her dark limb at 10h. 16m. P.M., at a vertical angle of 269°. On the 25th, 74 Aquarii, another 6th magnitude star, will disappear at the bright limb of the moon 57m. after midnight, at an angle of 80° from her vertex. It will not reappear at her dark limb until 2h. 11m. the next morning, at an angle of 308° from her vertex. Lastly, on the 31st, *f* Tauri, a star of the fourth magnitude, will disappear at the bright limb of the moon at 11h. 44m. P.M., at an angle from her vertex of 25°, and reappear at her dark limb 22m. after midnight, at a vertical angle of 297°. When these notes commence, the moon is in Cetus ("The Seasons Pictured," plate xxii.), out of which she passes at 7 o'clock in the evening into Pisces. She is travelling through Pisces until the same hour to-morrow evening, when she again plunges into the northernmost outlier of Cetus; and when she finally emerges from this at 4h. P.M. on the 3rd, it is to enter Aries ("The Seasons Pictured," plate xxiii.). By 2h. 30m. P.M. on the 4th, she has crossed Aries and entered Taurus. In the course of her journey over Taurus, she arrives at 1h. 30m. P.M. on the 7th at the western edge of the most northerly part of Orion. By 1h. A.M. on the 8th she has traversed this, and come out in Gemini ("The Seasons Pictured," plate xxiv.). She leaves Gemini for Cancer at 10h. P.M. on the 9th, and Cancer, in turn, for Leo at noon on the 11th. It takes her until 4h. A.M. on the 14th to traverse Leo, and she then enters Virgo ("The Seasons Pictured," plate xxv.). Her journey across Virgo finishes at 8h. A.M. on the 17th, when she passes into Libra ("The Seasons Pictured," plate xxvi.). Her path through Libra brings her at midnight on the 18th to the western edge of the narrow northern spike of Scorpio; and when, by 9 o'clock the next morning, she has crossed this it is to emerge in Ophiuchus. She passes out of Ophiuchus into Sagittarius at 9h. P.M. on the 20th, and from Sagittarius into Capricornus at 2h. 30m. A.M. on the 23rd ("The Seasons Pictured," plate xxi.). At 11h. 30m. P.M. on the 21th she leaves Capricornus for Aquarius. She remains in Aquarius until midnight on the 26th, and then quits it for Pisces ("The Seasons Pictured," plate xxii.). She passes from Pisces into Cetus at 7h. P.M. on the 27th, re-entering Pisces at 5h. A.M. on the 29th, only to pass again into Cetus at 2h. A.M. on the 30th. When she finally quits Cetus at 9 o'clock that night she enters Aries. She is in Aries until 10h. P.M. on the 31st, and then enters Taurus ("The Seasons Pictured," plate xxiii.). There we leave her.

Our Chess Column.

By "Mephisto."

THE following position occurred in a game recently played between Zukertort and Gunsberg:—

Gunsberg.
Black.



White.
Zukertort.

White played
22. Q to B2
which obtains a strong advantage in position; he threatens to win the Queen by B to Kt6. Q to R5 is no good, as White can attack the Queen by Kt to B3.

Black replied	22. Q to Qsq

which was not his best defence, as it increased the difficulties of the position by cramping his game still more. Kt to Qsq was better; if then 23. B to Kt6, Q to R5; 24. Kt to B3, Q to B3.

23. B to Kt6	23. Q to Ksq
24. B to QB5	24. Kt to K2
25. P to KKt4	25. K to Rsq
26. B to Q6	26. Q to Qsq

To prevent White playing Q to Kt6

27. Kt to Q4	27. B to R5

The sole idea of this move is to tempt White into advancing his Pawns on the Queen's side, thereby loosening his position and making a counter attack possible. The position, however, also required as a necessary accompaniment that Black should play R to Rsq. Not with a view to permanently defend the weak Rook's Pawn, but for the temporary purpose of enabling Black to bring his pieces into play, especially his Knight on Bsq, and to give up the KRP at a time when, by playing away the defending Rook, he should obtain some chance of a counter attack.

28. P to Kt3	28. B to Qsq
29. K to Kt2	29. B to Q2
30. P to B4	30. P × P
31. B × P	31. Q to Kt3

Black seizes a desperate chance to bring his pieces into play if

now 32. B × Kt, R × B seemed a compensating move, but it is not so, for White would then reply B to Q8, winning the exchange.

32. B × RP	32. Kt to Q4
33. B to Bsq	33. B to B3
34. Q to Q2	34. Kt to Q2
35. R × P	35. Kt to B1
36. B × Kt	36. Q × B
37. R to Bsq	37. Q to Kt3
38. R × P	38. R to Rsq
39. Kt × B	39. R × Kt

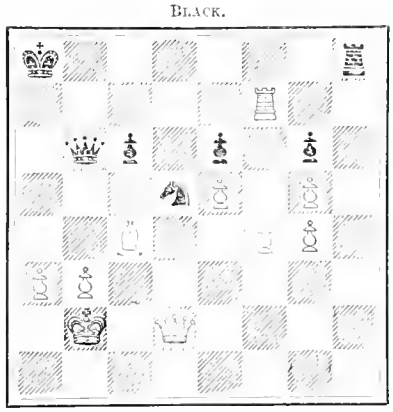
Black took with the Rook in order to exchange the White Rook, which acts as a protection to the King, in the hope of then being better able to menace White's position by means of the open Rook's file and the co-operation of Rook and Queen.

40. R × R — 40. P × R

Black, of course, relies upon the Queen commanding the important diagonal leading to Q5 and KB7, for the possibility of a counter attack.

41. B to B1

BLACK.



WHITE.

Black, although he is 3 Pawns behind, has obtained what he was playing for, namely an open game.

Now in this position there are various points to be considered. Firstly, if Black plays his R to R6 or R8, White might probably advance his Pawns, Black could never play his Knight away, as White could then play R to B8 (ch), followed by Q to Q7 (ch). The Black Queen is also confined to the diagonal she occupies, on account of the check on R5. Nevertheless, there are four moves at Black's disposal. The move actually played was weak, namely-

41. Kt to K6

42. B × P — 42. Kt to B8

43. Q to Kt1

and the position is hopeless as Black now has only one check, and he must exchange Queens.

Another move, which under circumstances might have been possible, but must now be dismissed as useless, is 41. R to R7. If now 42. Q × R, White will have no difficulty in avoiding the perpetual check consequent on Q to Q5 (ch). 43. K to B2, Q to B6 (ch). 44. K to Ktsq, Q to K8 (ch). 45. K to B2, Kt to B6 (ch). 46. K to Kt2, Kt to Q8 (ch). 47. K to B2, Kt to K6 (ch). 48. K to Q3, and White will escape the perpetual check.

A more likely move was

41. R to Qsq

If now 42. B + Kt — 42. R × B

If he does not take the Kt, White is threatened with many dangers, which promise to yield drawing chances:

43. Q to K2	43. Q to Q5 (ch)
44. K to R2	44. K to Ktsq
45. Q to Ksq	45. K to Bsq
46. Q to K2	46. K to Ktsq

and we fail to see that White can do anything but accept the draw, by playing

48. Q to Ksq

48. Q to B2 is useless, for Black simply answers Q to Q8, compelling White to play 49. Q to R8 (ch), R to Qsq. 50. R to B8, and Black draws by perpetual check.

Yet another move was

41. Q to Kt8

threatening to win the Queen; but then White could reply 42. B to Q2, as Black dare not move his Rook to R7 on account of Q to R5 (ch) and Q to Q8 mate. White could also venture on giving up his Queen by playing 42. B × KtR – R7, 43. B × P (ch) with a good prospect of winning.

THE HANDY CHART OF CHESS OPENINGS.*

Mr. Allan Greenwell, of the Newcastle Chess Club, has adopted an old idea, and made it serve a useful purpose. His "Handy Chart of Chess Openings" is, properly speaking, an index to all the Openings, and it is compiled in the manner of a tree, which makes it easy, after but a slight survey, to trace almost every move that is ordinarily played to the class of Opening to which it belongs. Of course if it is desired to follow up any particular variation, then a handbook on the Openings must be consulted. Nevertheless, although the chart, as before said, does nothing more than index the various Openings, it appears to us to be of invaluable service, as it brings within bird's-eye view the whole vastly complicated system of the Chess Openings, enabling every one to make himself familiar with the Openings, a knowledge which they might not otherwise acquire in a lifetime. We give a few specimens of this chart, which should be in possession of every chess-player.

W. 1. P to K4	P to Q4	Kt to KB3	P to QB4
	Queen's Opening	Zukertort's	English Opening
B. 1. P to K4	P to K3	P to Q4	P to QB4
	French Defence	Centre Counter	Sicilian
W. 2. Kt to KB3	P to KB4	B to B4	QKt to B3
King's Knight's Game	King's Gambit	Bishop's Game	Vienna Game
B. 2. Kt to QB3	P × P — —	B to B4	——— P to Q4
	Accepted.		Declined.
W. 3. B to B4	P to Q4	B to Kt 5	Kt to QB3
	Scotch	Ruy Lopez	Three Knights
B. 3. B to B4	Kt to KB3	P to QR3 ———	Kt to B3
Giuoco Piano	Two Knights' Defence		

We would suggest that four more of these charts should be issued, namely, one for the King's Knight's Opening, one for the Bishop's Openings, one for the King's Gambits, and one for the Queen's Gambits. Thus completed, they would be extremely useful.

An untimely draw occurred the other day, which is worth recording, as it presents this curious fact, that a strong player was forced, very much against his will, to accept a draw after merely ten moves had been played. Theoretically this seems almost an impossibility, but practically such positions do occur. The game was played as follows:—

1. P to K4	1. P to K4
2. P to QB3	2. P to Q4
3. Kt to KB3	3. Kt to QB3
4. B to Kt5	4. Q to Q3
5. Q to R4	5. B to Q2
6. P × P	6. Q × P
7. Castles	7. B to Q3
8. P to Q4	8. P to K5
9. Kt to Kt5	9. P to KR3
10. B to B4	10. P × Kt

White now takes the Queen, and Black draws by perpetual check.

* Published by Franklin's, Newcastle-on-Tyne, price 6*d*.

LAND ABOVE THE SEA LEVEL.—Mr. John Murray (of *Challenger* Expedition fame) has read a paper before the Royal Society on the height and volume of the dry land, and the depth and volume of the ocean. Only 2 per cent. of the entire ocean is included inside a depth of 500 fathoms, whilst 77 per cent. of the area lies between 500 and 3,000 fathoms, and the mean depth of the ocean is 12,180 feet. The mean height of the land above the sea level is 2,250 feet; so that if all the land were utilised to fill up hollows in the earth's surface the sea would cover it to a uniform depth of two miles.

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THE SCIENTIFIC ORIGIN OF RELIGIOUS DOCTRINES.

I.—IMMORTAL LIFE.

BEFORE considering the way in which the doctrine of the immortality of the soul resulted from the study of observed facts, and therefore had a scientific origin, it will be well to touch briefly on certain considerations which influence men—with or without just reason—in maintaining this particular doctrine.

Most of us are trained from childhood upwards not only into full faith in a future and immortal life, but into the belief that in this faith there is comfort for all the ills to which mortal flesh is heir. The mere suggestion of doubt respecting the immortality of the soul is regarded as tending to deprive the world of hope and comfort. It is in connection with this faith that the dreary question has been asked, Is life worth living? and the answer given by most men to the question has been, Were this life all, it would not be worth while to live. Our English poet laureate has expressed the thought, when he says that if man's fight with Death be vain, and science proves we are but magnetic mockeries, cunning casts in clay,—

> Then
> What matters science unto men,
> At least to me? I would not stay.

Yet few who thus express and doubtless feel the sense of comfort in the hope of an immortal life ever consciously reflect on what they hope for. Few even have considered whether their faith in a future life is comforting for what it promises themselves or for what it promises in regard to others.

Many of honest mind, when asked whether there is much of comfort for them in the thought of an everlasting consciousness, including the clear recollection of all the events of this life, admit readily that such eternal remembrance would be infinitely painful. Even in this life, after a certain stage has been reached, most men feel that life would be scarce endurable but for the power we possess of diverting the mind from sorrowful reflections, and especially from brooding on the memory of those dear to us whom we have lost. We would not indeed forget such sorrows if we could; we even feel it to be a sacred duty from time to time to recall them vividly to remembrance: but were we to dwell constantly upon them, were they ever present in our minds so that we could not dismiss them, we should go mad. Yet what but ever-present consciousness of our whole earthly lives is promised, or threatened, by the faith in immortality?

If we view the immortal life as it relates to others, we quickly find reason not only to doubt how far faith in such life is really comforting, but also to question whether we have really entertained it so confidingly as we had imagined. If we cannot well conceive immortal life for ourselves without assuming that it includes conscious remembrance of all things that have happened in the earthly life, we are equally unable to imagine the immortal life of those dear to us without conceiving them conscious of all that takes place in our lives here. While as yet unwilling to ask our inner selves what we really believe and hope, we may hope that the spirits of departed dear ones will

> Be near us when we fade away,
> To point the term of human strife,
> And on the low dark verge of life
> The twilight of eternal day.

But while that human strife goes on, do we really believe that the dead whom we loved are near us, and know all that passes in our thoughts as well as all the actions of our life?

> Do we indeed desire the dead
> Should still be near us at our side?
> Is there no baseness we would hide?
> No inner vileness that we dread?

It has been said that did the Catholic really hold in his heart the faith he accepts with his reason and professes with his lips, his reason would stagger in the actual personal presence—as he believes he believes—of the God of the universe upon the altar before him. It may be said with equal truth (and it is a truth more easily grasped) that if men believed in their hearts that but one of those dead whom they loved through life were still, in some changed condition, conscious of their thoughts and actions, none but the innately vile could commit any evil action, however slight, or conceive any thought which a child might not confide to his mother, a son to his father, a husband to his wife. Would not the thought of each be that, if indeed

> The dead shall look us thro' and thro'—
> Shall he for whose applause I strove
> (I had such reverence for his blame)
> See with clear eye some hidden shame
> And I be lessened in his love?

Truly it would need no perfect faith in the supervision of all things by deity to make the believers in an immortal life refrain from every wrongful act, from every evil thought. There is scarce one among us who numbers not one at least among his dead, for whose sake he would be blameless in thought and deed, did he indeed believe, as so many of us suppose we believe, that the death of the body is but the beginning of an eternal spiritual life, in which those loved in the earthly life are loved still, and all that they do is known and cared for.

If, turning from definite thoughts of an immortal spiritual life, we consider only the vague faith in an unknown and mysterious hereafter, we find reason to fear that this faith, though it has been comforting to many, has been distressing to a much larger number of those who hold it. Do what men will to keep the faith vague, they cannot for the most part refrain from trying to picture it to themselves in detail. The natural wish to define a faith which has been made so large a part of most men's lives shows itself most strongly (as a rule) at the time when men first begin to recognise the possibility that death may be near at hand. As the actual moment of death draws near there is little power and little desire for definite thought; the brain grows weary as the moment for its final sleep draws near, and is content to accept vague comfort from those round the death-bed. But few who have had occasion to follow the thoughts of those dear to them during the progress of fatal illness have not been pained by anxious questionings addressed to those who have professed to teach with greatest confidence the doc-

trine of a future life. The faith which had been a vague comfort during active life, when its real significance was little thought of, the faith which as death actually approaches may again become vaguely comforting, is at this earlier stage of the close of life a source of distress and discomfort. Something of the feeling of anxiety expressed in the lines attributed to the dying Hadrian may be recognised in the thoughts of the dying ere yet the heavy hand of death is actually upon them :—

Animula vagula blandula
Hospes comesque corporis,
Quæ nunc abibis in loca ?
Pallidula, rigida, nudula,
Nec (ut soles) dabis joca.*

But if such fears often attend the death of those who, though they have not really believed during life that after death comes judgment, and may come eternal tortures, have never reasoned out their unbelief, and in the weakness of mind which (always or nearly always) precedes death are moved by anxiety as vague as their past confidence had been, how much longer and more seriously have those suffered who have watched the deathbeds of those dear to them, feeling certain that the dying have by their lives condemned themselves to eternal punishment after death ! If this were merely the creed (whether but professed or otherwise) of those whose whole care during life has been to tell other folk their duty, and to condemn the world in such sort as to gain credit with the foolish for superior virtue, it would not be worth considering. But alas ! it is and has been the faith, and being the faith the fear, of tens of thousands of the really devout. Others than the evil—some who are akin to men's fancies of what angels might be—"believe and tremble," not for themselves, but for those dear to them whose faith is not as theirs, whose lives have not been all that these pure-souled ones believe to be essential to salvation. It is only the pulpit professors of religion who dare to repeat the monstrous untruth that the belief in a future life has on the whole brought comfort to devout believers. The best of the believers, those really earnest in their belief, refuse to be comforted by the thought of an eternity of future happiness for themselves, in their anxiety lest those dear to them should incur eternities of future torment, and still less in their certain conviction that some among those dear to them who have passed away must be punished for ever and for ever. Just in proportion as we recognise purity of heart and earnestness of devotion in those who possess fulness of faith, are we certain—we who have known and loved these simply believing single-hearted devotees—that they suffer anguish unspeakable at the thought of the probable future of many whom they love, the certain future of not a few for whose welfare in the next world they care more than for their own either in this world or the next.

The preachers who proclaim their conviction that belief in a future life has been a solace to the hearts of those who have loved and lost—to the parent sorrowing for the child, or child for parent, to spouse widowed of spouse, friend left lonely in the world for friend—either say they know not what or proclaim what they must know to be untrue. The pulpit preacher of comfort in the thought of the everlasting life is ready enough no doubt, beside the funeral baked meats, to speak idle words of comfort to parent or child, to wife or husband, to brother or to sister, of the dead who was so dear ; but scarce are the words passed from his lips in which he tells the sorrowers that their dead have passed to a happier life, before he will proclaim to others his conviction that not eternal happiness but eternal misery must be the fate of most of us, of all who do not believe as he believes. It is those, however, who really believe who really suffer in the thought of all their belief implies ; and were it not that, happily, their minds are not able to wholly grasp that thought, their whole lives, after even but one of those they loved had passed away under such conditions as would render eternal happiness doubtful or inconceivable, would be lives of misery. Nay, it seems to me that they scarce *could* live—or, at least, live sane ; that they must either die or go mad, if it were not for some vague thought that it cannot really be as nevertheless their faith is ever telling them it must be. Possibly few among those who hold most earnestly the faith we are considering, and therefore feel most strongly that not to hold that faith is of itself a sin to be punished by all that that faith threatens, have perceived that did they accept all their faith teaches logically the heart would be moved to anguish so exquisite and so enduring that life or reason must give way.

* Pope, in a letter to Steele, comments on the opinion that these verses were trifling and unworthy of Hadrian's death-bed. The thoughts expressed by the dying emperor seem to him, he says, most natural and appropriate. Doubtless he was right. There is nothing of jest, though there is a humorous tenderness, closely akin to pathos, in Hadrian's last words. Yet for a poet Pope shows but slight appreciation of the essential quality of Hadrian's thought. He translates it, both in prose and verse, into something wholly different—into the expression of reflections which would be neither natural nor appropriate—since dying men are not apt to adopt artificial mental attitudes any more than artificially to pose their bodies. "Alas my soul !" runs Pope's prose translation, "thou pleasing companion of this body, thou fleeting thing that art now deserting it ! Whither art thou flying ? to what unknown scene ? all trembling, fearful, and pensive ? what now is become of thy former wit and humour ? Thou shalt jest and be gay no more." Forty-eight words to represent twenty ; or twenty-five if such words as "vagula," "pallidula," &c., be regarded as double ! Yet the most characteristic idea of the original is not conveyed at all. Pope's translation of Hadrian's lines into poetry is better. Of course I am not referring to his well-known "Vital spark of heavenly flame !" which was written in response to Steele's suggestion that Pope should show how the dying Christian would address his soul, but to the lines :—

Ah fleeting spirit ! wand'ring fire
That long hast warmed my tender breast,
Must thou no more this flame inspire ?
No more a pleasing cheerful guest ?
Whither, ah whither art thou flying ?
To what dark undiscover'd shore ?
Thou seem'st all trembling, shiv'ring, dying,
And Wit and Humour are no more.

Yet this version errs like the prose translation both in excess and defect. There are ideas in it which the original does not contain, while the characteristic idea of the original, the tender anxiety of the dying man for his soul after it shall have left the shelter of the body, is not conveyed. The seventh line is also singularly weak : the suggestion that the soul of a dying man seems to be dying is indeed a little worse than weak. Nor has the original a word about seeming. As for the last line, it does not correspond at all with the idea conveyed in the words, "Nec (ut soles) dabis joca."

A correct translation of Hadrian's verses must suggest something of their brevity, something of their quaintness, and something, also, of their roughness, all of which belong as much to the little poem as the idea, missed by Pope, that it is for the soul and not for the soul's host that pity and sorrow are to be expressed.

The lines might, I think, be fairly presented in some such way as this :—

Poor little wand'ring tender soul,
This body's friend and guest,
What places will you visit now ?
Pale, cold, and naked little waif,
Unwilling now (as once) to jest.

Even this is redundant, and a more accurate translation, which, though rough, is not perhaps much rougher or quainter than the original, might run :—

Wand'ring tender ghostie !
Body's friend and guest,
What places seek you now ?—
Pale, shivering, stript,
Nor as of yore wilt jest.

Compared with the misery which the tenderest and truest men and women have suffered, and must suffer, at the thought of some at least among their lost dear ones enduring an eternal life of suffering (or were it even but the loss of the eternity of happiness of which their faith assures them), the cruelties which men have inflicted on their kind because of faith in the doctrine of everlasting life, may be regarded (terrible though they have been) as adding relatively but little to the sum-total of misery which the doctrine—be it true or false—has assuredly entailed upon the human race. Moreover, the contemplation of man's cruelty to man in the holy name of religion tends to wrath rather than to sorrow. Therefore I will leave such considerations here untouched.

ENGLISH PRONUNCIATION.

(*Concluded from p.* 198.)

THE passage in "As You Like It," where Celia ridicules Le Beau's pronunciation, "spot" for "sport," suggests not only that in Shakespeare's time the "r" was rolled, but also that the pronunciation of the "o" was then more nearly like our "u" in "but," or that "spot" was pronounced "spoot," and "sport" "spoort." For there is now a marked difference between the vowel sounds in the words "spot" and "sport," whereas, Celia's play on the words suggests that, but for the "r" lost in Le Beau's affected pronunciation the words had the same sound. There is, indeed, reason for supposing that as "a" in old times was "ah," and "e" was our "a" (as in fate), so "o" was more nearly our "u." Thus we find Constance saying:

O lawful let it be
That I have room with Rome to curse awhile.

In old Scottish writing our word "but" appears nearly always "bot." The pronunciation "gould" for "gold" is even yet heard in many parts of England, and is common in Ireland and Scotland. And the "u" sound in such words as "shoe," "London," &c., serves to show that "o" was regarded of old as representing this sound. (Observe that this being so, the "u" sound in "London" is not a modern corruption).

On the other hand, there is no reason for supposing that "u" originally represented the sound of "iu" or "yu" given to it now. The pronunciations "dook" for "duke," instead of "dyook," and "Toosday" for "Tyoosday," should be regarded rather as archaisms than as vulgarisms.

We have already seen that diphthongs like "ea" in English, "ai" in French and the various combinations used at different stages of the progress of a language as spoken and written, give useful information as to the force of the simple vowels in past times. As steady changes have taken place in this respect, we can not always be quite certain as to the force of a simple vowel at any given time, or even of a diphthong, though the latter is usually a much easier matter. For instance, old Pepys spells the word "skate" (not the fish, which, so far as I know, is not mentioned in his diary) in both the forms, "skate" and "skeat." We can infer from this that in his time "a" had already lost the "ah" sound, since "skeat" cannot possibly represent the sound "skaht," while "ea" still represented the sound of "a" in fate. But we know that long after Pepys' time the proper sound for "a" was regarded as "ah." The first letter of the alphabet was even called "ah" till a much later time in England, and is still so called in Ireland, R being distinguished in sound by being called "ahrr"—justifying the name given it by the nurse in "Romeo and Juliet"—"the dog's letter."

Let us consider another diphthong, "ei." If this is dealt with according to the known sounds of "e" and "i" in long past times, we see that it represented the sound which we should now write "aee" given as a diphthong. Here we recognise the justice of the rule suggested at the outset, that the further we go from the parent stem the more likely we are to find the older pronunciations adhered to. The Englishman says "eyether" and "neyether," the American says "eether" and "neether," which is decidedly nearer the old sound. But when the Irishman was asked: "Do you say 'neyether' or 'neether,'" he answered, "I say 'nayther,'" an answer doubly true. For it tells the Irishman's practice, and it indicates what really is the true pronunciation of the word, if old fashion is to be followed. Moreover, though it would decidedly be a solecism now to say "ayther," yet the knowledge that this is the true pronunciation is useful, as helping to show the origin of the word from the old Saxon "aegther" contracted from "aegh-wæther" *i.e.* "each-whether." (In passing we note that, according to the interpretation we have found already for "ea," "each" would be properly pronounced "ayteh," by which the connection existing between "either" and "each" is clearly enough indicated—I mean, by noting that they were sounded "aytch" and "ayther." This connection is not lost in the American pronunciation, but it is entirely lost when we pronounce the words as in England "eetch" and "eyether.")

One of the strangest features of our English speech to Americans is the pronunciation of such words as "Derby," "Hertford," "clerk," &c., "Darby," "Hartford," "clark," and so forth. Here both countries have changed their modes of pronunciation, but in opposite directions (I refer to the more usual American pronunciation of such words, for in New England we not unfrequently hear "clark," &c., as in the old country). There can be no doubt that the original pronunciation of "clerk" was like that given still to the word "clere" in France. For we are certain that the word is of French origin, and we are equally certain that its pronunciation in France, always represented by the same vowel letter, has changed very little, if at all. The word then of old was pronounced "elairk"—as we should now write the sound. "Clerk," no doubt, represented that sound rightly enough of old. In Scotland this is the way the word is actually pronounced, often even by the educated, though they recognise that in Great Britain at any rate custom requires the sound "clark." In England the correct intermediate sound "elairk" gradually changed towards "clark" till this usage became established. In America the spelling of the word seems to have regulated the pronunciation, at first, among the educated, from whom (as was natural in colonial communities) the rest took their pronunciation. Hence, as the force of "e" in spelling gradually changed to its present "er," or short "u," value, "clerk," pronounced "elairk," gradually changed to "clurk." But the proper name spelled and pronounced Clark, Clarke, &c., shows in America as in England how usage long since established the English pronunciation of the word. So does the American spelling of the name "Hartford." Here the influence of teaching could not, as in the case of the scholarly "clerk," bring the general body of the community to say "Hurtford," for men never willingly alter the pronunciation of old home-place names. So, as the mountain would not come to Mohamed—"the proverb is something musty"—they altered the spelling to correspond with the common pronunciation, since the common pronunciation would not conform itself to the spelling. Yet Americans should not allow the spelling, "Hartford," to destroy re-

membrance of the fact that Hartford, of Connecticut, was named after old Hertford, in England.

Many words regarded as Americanisms, and in one sense very properly so, are in danger of losing the evidence of their old English origin through the changes of sound that have come over our simple and diphthongal vowels. For example, consider the words "peart" and "slick." These are commonly regarded as provincial English in origin, and as Americanisms because they are apt to be heard all over America and to be used by classes which in England do not use these words even in the very districts where they are commonly used by the working orders. In reality, these words are simply "pert" and "sleek" differently pronounced. Analysing them according to the rules we have recognised, we see that neither "pert" nor "peart" can be the original pronunciation of the word "pert." "Slick" and "sleek" are both very near to the old pronunciation of "sleek," probably "slick" the nearer of the two. (We have in the Danish "slikke," in Icelandic *slikr*.) As for "pert" it is derived from the old French "apert," still existing in combination in the word *malapert* (which shows, by the way, that originally the word "pert" implied no rudeness or impertinence). Therefore, the original sound was "pairt"—as we should now spell it. This would be represented in old times by "peart"; and, indeed, we find Sir Philip Sidney spelling the word "pearte," writing of "pearte boldness" (not, be it noticed, simply "peartness" as he would if the word "pert" alone had had in his day an unpleasant significance). It was also written "peert," just as "great" is written "greet" in the passage quoted near the beginning of this essay. But with the known force of "ea" and "ee" in old times, each spelling assures us that the original pronunciation of the word was "pairt," and that the "pert," "peart," and "peert" of to-day are one and the same word, all of them more or less corrupt in pronunciation.

Before leaving the English vowels, about whose sounds, however, a volume might be written and thousands of curious examples produced, I must note one or two usages which, at a first hearing, seem (to Englishmen at any rate) peculiar.

Take first the "a" in "bath" and such words, which Westerners are so tickled by when they hear it from an English mouth. The true English sound is "bahth," not as too often rendered in America (by an exaggeration of our method) "bawth." Now, this is nearer the old pronunciation than "bath" with the "a" as in "fat." The New Englander who says (not that all do) "mahn" for "man" is probably nearer the old sound than the Englishman who says "man"; but the Westerner has departed from old usage still farther when he says "bath" with the "a" as in "bat."

In America the country folk mostly say "wrastle" for "wrestle." Here both the English and the country American pronunciation are corrupt; though, of course, no educated man can say anything but "wrestle." "I would have told you," says Le Beau in "As You Like It" (folio edition), "of good wrastling"—and "wrastle" it is all through, whether the Beau, or Celia, or Rosalind, the Duke, Orlando, or Charles the Wrastler himself, uses the word. But how was the word pronounced? It could not possibly have been "wrestle," as we say it. It might have been either with the "a" as in "fat," "fate," or "far," "wrassel," "wraystle," or "wrahstle." Probably the word was pronounced "wraystle," which would be correctly represented in Shakespeare's time by "wrastle," and a little later by "wrestle" (now representing a different sound). The old Saxon verb was "wraestlian"; that origin, as well as usage in regard to vowel letters, would indicate this pronunciation. The American and country English pronunciation are obviously nearer the old form than our modern English and the cultured American usage.

I have mentioned an American way of pronouncing the word "very." It chances that this was the first Americanism I ever noticed, and I noticed it rather early in my American experience. I had had but one conversation with an American, on business, in which I had noticed no difference, unless the careful pronunciation "afterwards" for our clipped English "afterw'ds" could be called such, when, on Friday, October 2, 1873, I travelled from London to Liverpool in the same carriage with an American lady and gentleman. At Euston the gentleman asked his wife some question about his luggage; the answer, "I'm not vuhry sure," introduced to my notice the pronunciation I refer to. ("Vuhry" does not represent the exact sound; the vowel tone is correctly represented by the "u" in "fur," but there is a curious rest on the first syllable, which gives the "u" sound a little more stress than it has, for example—in the word "furry.") In England, of course, "very" rhymes perfectly with "merry." But the English pronunciation is certainly a corruption. The word was indeed formerly written "verri" as well as "veray," and in the French *vrai* we have evidence of a sound nearer to our English "very" than to the Americanism we are considering. But the original French word was "verai," and the Latin "verus" indicates the proper pronunciation of the "e" as in the modern Italian "ver" ("e" like "a" in "fate"). The Scotch in their "vara" are not quite right, neither are we in England. Nor is the Americanism right. The incorrupt pronunciation which, however, would by no means be correct now, would make "very" rhyme very nearly with "fairy."*

And now a word or two on the consonants. It might seem that they can undergo little change—a "t" is a "t" wherever the English language is spoken, nay all the world over. It may be altered into a "d" or into "th," but it is not of such alterations that I am here chiefly speaking. Rather I am trying to show that the actual force of particular letters has changed. It seems at first sight impossible that consonantal letters can have altered in their actual force as we have seen that vowels have. Yet not a few of our consonants have altered in this manner. Take first our old friend the letter "h." I am not about to dwell on the special English misuse of this letter, which, indeed, I considered fully about two years since in the pages of the *Atlantic Monthly*. I am preposing to show what many, I believe, will be somewhat surprised to learn, that the letter "h" originally represented more than a mere aspirate. The English race began to misuse the "h" long before they began to drop their aspirates and to throw aspirates in where they are not wanted. Consider first the very name given of old to this letter and still used, though its significance has long since passed away. We call the letter "aitch." Every other consonant is called by a name which includes the force of the letter, and no other consonantal force whatever. In the name of "h" alone there is a consonantal force which is more than the letter itself, however fully aspirated or even exaspirated, ever has in our mouths. Is there not some evidence here that "h" formerly had a similar force?

We may here pause a moment to ask if the letter were always so called, or if the name given to it, though similarly

* One of the oddest of all the vowel changes I have ever heard of has recently come under my notice. I had long observed that uncultured persons in America spoke of Eyetalians for Italians; Rooshans (like Mrs. Gamp) for Russians, and so forth; but that our old familiar Louisa should be pronounced Lou-eye-sar was, I must admit, a new and painful experience.

spelled, were similarly pronounced. We have curious evidence on this point in "Much Ado About Nothing." "By my troth," says Beatrice, "I am exceeding ill. Heigh-ho." "For a hawke, a horse, or a husband?" asks Margaret. "For the letter that begins them all, h," that is, for an "ache"—heartache, as Margaret presently hints, when she says, "God send every one their heart's desire." Now we know that the word "ache" was formerly not always pronounced "ake," but often "aitch"—or at any rate in such a way that "aches" was a dissyllable. For while we have in the folio (our best guide in such matters) Othello saying, "Smell'st so sweet that the sense akes at thee," we have in "The Tempest," "Fill all thy bones with aches"—and other examples attesting a variable pronunciation. (The elder Kean, following, it is said, Charles Kemble, pronounced "ache" invariably "aitch." But be this as it may, Beatrice's remark assures us that there was a consonantal force in the name of the letter "h." Indeed, the very circumstance that "h" appears in the name "ache" is significant both as to the original pronunciation of the word and as to the original force of the letter. There is no trace of aspiration in the word "ache" as we pronounce it; but also there is no trace of the present force of "h" (or rather its want of consonantal force) either in "ache" pronounced "aitch," or in such words as character, chagrin, or architect. The variability of the present force of "ch," combined with the entire absence of any aspiration in pronouncing any form of the compound letter, shows that originally "h" represented more than a mere aspiration, and probably represented more than one consonantal effect.

Hence we can understand what otherwise seems so singular, that our "hard" is regarded by philologists as akin to the Greek *kratos* or *kartos*, strength; that "horny" and "corny" are akin; that, conversely, our "garden" (which is the Saxon "geard" and the old English garth, etymologically identical also with "yard"), is from the same Aryan source as the Latin *hortus* and the Greek *chortos*, an inclosed place for feeding. In the last word, resembling the French form, *jardin*, we find h, g, y, j, ch, all doing duty in turn—which affords tolerably clear proof that "h" had originally more than mere aspirational force, though it shows also that the force of the letter was variable and unstable.

Here, however, we are confronted by the fact that in old Saxon words which afterwards had a decidedly guttural pronunciation, and which are to this day spelled in such a way as to show how they must formerly have been pronounced, "h" does duty for the guttural. Thus, our "light" and "sight" were in old Saxon "liht" (or "leoht") and "siht." It is certain the "h" had some meaning here, equally certain that up to the fifteenth century these words had a guttural pronunciation; and it is incredible (as contrary to the spirit of English language changes) that a guttural should have replaced some lighter and easier pronunciation, represented by the "h" in "light" and "sight."

We can understand, also, when we recognise the consonantal force given to the letter "h" of old, the singular combination "hw" constantly used in Saxon where we write "wh." Thus "hwil" represented our "while," and "who, which, what, when, why," &c., were respectively "hwa, hwile, hwæt, hwænne, hwi," &c. The corresponding words in Latin began with "qu," representing probably the sound "chw" ("ch" guttural) rather than "kw." We retain only the "w" sound, having almost lost in England even the aspirate part of "wh"; the French retain only the "k" sound, to which the Italian "ch" is now equivalent, though probably once guttural. In Scotland the full consonantal sounds were long retained in the old forms "quhile," "quha," which probably resembled very closely in pronunciation the Saxon way of pronouncing "hwil," "hwa," &c.

Much might be said about the letter "h" as it now appears in such combinations as "th," "ph," &c. There is abundant evidence that the two sounds now represented by "th," as in "thought" and "that," are really corruptions of sounds correctly represented by "t" aspirated and by "d" aspirated respectively. These sounds are still retained in parts of Ireland.

Our modern "j" again is a corruption of a sound nearly akin to the consonantal "y."

The changes which have affected the letters "l" and "r," as shown by many passages in old plays (for instance, in the play on the words "Walter" and "water," in Henry VI., part 2, act 4, sc. 1), are well worth studying by those who wish to form some idea of the way in which our mother tongue was probably spoken by our forefathers, and in particular by those among our forefathers to whom we owe the parentage of English literature.

But for the present—*sat prata biberunt.*

COLOURS OF ANIMALS AND FLOWERS.

I WAS watching not long ago the behaviour of a chameleon in the midst of the bright green leaves of ivy (of the kind sometimes called railroad ivy) in a Florida garden. The lizard (Dendrosaur, if the lovers of long words prefer it) was so nearly of the same colour as the surrounding leaves that my eye could detect no difference, though I have a keen sense of colour differences. While I watched, two events took place, each of which illustrated the value of the chameleon's then displayed colouring. A small fly, itself somewhat resembling in colour the ivy leaves, but as it appeared not sufficiently so for safety, settled on a neighbouring leaf. In an instant the tongue of the chameleon was protruded and withdrawn, so quickly that the motion could hardly be detected; but after the movement the fly was no longer on the leaf, nor had he flown away. The chameleon seemed to know where that fly was, for one of its globular eyes, which had for a moment only been directed on the fly, was turned towards myself with a look which seemed to say in chameleon language, "I had him there," the whole aspect of the lizard showing that he still had him. A few moments later the gardener approached, whom the chameleon seemed to know better than it trusted him, for it slipped away among the leaves so deftly that the eye could barely follow its movements. (It must not be inferred that the gardener had made attempts on that lizard's life; on the contrary he valued the chameleon for his services; but he had often disturbed it by watering the plants on which it rested, and this was an indignity which that little Dendrosaur resented.) A few minutes after, the gardener having retreated, the chameleon was on one of the sticks supporting the garden ivy, and there it gradually assumed the same colour, so far harmonising with the stick that he seemed only an excrescence upon it, not a live creature which a short time before had been light green in colour.

Among the various developments—protective, destructive, or simply attractive—observed in animals and plants, few are more interesting than colour. Let us consider a few illustrations of the various forms in which colour affects the development of life.

Consider the striped tiger, on the one hand, as an example of colour in an animal which lives by preying on others, and the zebra, on the other hand, as an example of colour

in an animal whose life depends on its not becoming the prey of carnivorous animals. We can understand how, in certain regions, those members of feline races who chanced to have markings on their bodies which corresponded in appearance with the stems of trees, or with jungle reeds, and the like, would be better able to remain concealed till the animals which formed their prey came within range of their spring, and so would have the best chances of living—for carnivorous propensities have their life-supporting as well as their life-destroying aspect. And in like manner, although the zebra is chiefly protected from carnivorous enemies by his almost unrivalled speed, yet the zebra has his occasions for rest and sleep, and it is manifestly to his advantage, when sleeping in the shade of trees, to have markings on his body which from a distance would be confounded with the stems of trees and shrubs beneath which for awhile his active limbs were at rest. For so would he best escape the attacks of animals of prey.

It is noteworthy that when the zebra is stretched on the ground the stripes on his legs as well as those on his body are vertical as seen from a distance. The same is the case with the tiger's stripes when the animal is couched for a spring.

We can understand then how in the course of many generations the tiger would develop his stripes to aid him in attack, and the zebra develop his to give him safety—for the less striped of either race would have the worst chances in life's struggle, and so be steadily eliminated from the stock—as surely (in the long run) though not as uniformly as the inferior members of flocks and herds are removed by the breeder. In like manner and to like advantage, the leopard and the jaguar have their spots, simulating the spotted shade of leaf-bearing trees, the lion has his sand-hued body, the antelope (besides his speed) his colour akin to the surface over which he urges his course, and so forth. Some animals even change in colour with the season, or are modified according to habits; for instance, the alpine ptarmigan is white in winter, and the red grouse resembles in colour the heather; leaf-eating insects are green; those which feed on the bark are grey, or brown, or mottled.

Apart from the interest which such cases have in themselves (to mention only these few, and not the thousands whose mere names would fill all the space available to me), there is singular, to me impressive, interest in the evidence which these characteristic colours and markings carry with them, even through untold ages, of their origin and persistence. Only a few minutes ago there passed across the porch outside my study window a sandy-coloured cat marked with stripes such as hundreds of thousands of years ago were of value to its remote ancestors in the struggle for life. But though it is wonderful to see such a feature as this handed down through generation after generation after the time when they were of essential use in the struggle for life, there is something to me even more impressive in the latent continuance of such characteristics. A few minutes ago I saw ploughing a field of mine a mule, round whose legs, near the joints which we call the knees in the forelegs and the hocks in the hind legs (really corresponding to the wrists and heels of man), are seven or eight rings precisely corresponding to the rings round the corresponding parts of his remote ancestor, the zebra. Through thousands of generations, in the horse and the ass, these stripes have as it were remained dormant—though for aught I know they may have occasionally shown themselves in particular individuals, even as in particular men special monkey or ape-like traits may show themselves. But, as we know, such markings are so exceptional among horses and among asses that the animals showing them are regarded almost as monstrosities. Yet *there* has been lying in wait in the blood of both races, during hundreds of thousands of years, this particular trait of the wild ancestral race, ready to show itself when the two descended races should be crossed. The case is akin to the appearance, when breeds of fancy pigeons are crossed, of young which are scarcely to be distinguished from the wild ancestral rock-pigeon; but in one case we can trace back the line on either side to the blue rock-pigeons through a limited range of removals. In the other we have the immense range of time to deal with which separates the branching off of the equine and asinine stocks out of that particular family of hippic animals from which the descent of both began.

The colouring of animals is not always of this simply protective character, however, though always (so far as can be judged) playing an important part in developments. There are some cases in which it has been found difficult, even impossible, to account for the difference which undoubtedly exists in regard to the struggle for life between animals of the same class differently coloured. In the human race itself we find races of different colour affected in different degrees by specific diseases. "The colour of the skin," says Darwin, "is sometimes correlated in a surprising manner with a complete immunity from the action of certain vegetable poisons, and from the attacks of certain parasites. Negroes and mulattoes are almost entirely exempt from yellow fever and from the intermittent fevers which prevail along the shores of Africa. The susceptibility of animals to the attacks of insects is found to be correlated with colour. So also is the liability to be poisoned by particular plants." Professor Wyman informed Darwin that the farmers in Virginia found only black pigs capable of resisting the effects of paint root. White sheep and pigs are injured by plants on which the darker-coloured animals can feed with impunity. Hundreds of such cases could be cited.

In another respect colour plays an important part, viz., in influencing sexual selection. It is not as yet easy to say in some cases whether this or some protective or concealing influence is really in question. Thus, as Darwin remarks, the colour of the green woodpecker seems "a beautiful adaptation to conceal this tree-frequenting animal from its enemies;" but we know that there are many black and pied varieties, so that he concludes that "the colour is probably due in chief part to sexual selection." It does not seem clear that in this particular case the latter interpretation is forced upon us—since most of the pied varieties seem as well protected by their colour as the green; and, in fact, we find them for the most part frequenting trees whose bark or foliage harmonises with their own prevailing tints. Moreover, we have already seen that the insects on which woodpeckers live, including leaf-eaters and bark-feeders, are diversely coloured to correspond with these special habits. Why should not the same variety be found among the birds which seek them? Even the red-headed woodpecker is not quite certainly to be regarded as an exception; still in his case sexual selection seems to be the explanation naturally suggested. In many cases there can be no doubt that peculiarities of colour in animals of various kinds have been developed mainly in virtue of natural selection, or have at least been carried far beyond the requirements of mere protection.

In the vegetable world colour seems to be in all cases dependent on the requirements of propagation. Thus where seeds are diffused by animals, as with the berries, we find the fruits brightly coloured to attract the attention of the animal distributors. It may be noticed that where seeds are distributed by the winds bright colours are not found in the fruit, even though the plant be closely allied to species

where the bright colours are present (the distribution being effected by animals).

The colours of flowers have been shown by the researches of Sprengel, Fritz, Hermann. Miller, Darwin, Lubbock, and Wallace to be necessary (or rather to have become necessary) for the attraction of certain species of insects by which the pollen may be transferred from the stamens (of one flower) to the pistil (of another) and (cross) fertilisation effected. Mr. Grant Allen, in his charming little book on the "Colours of Flowers," has advanced and supported by very striking evidence the interesting theory that the colours of flowers range in order of development: 1. From white found in flowers "which lay themselves open for fertilisation by miscellaneous small flies;" 2. to yellow found in flowers which depend on small beetles; and 3. to red, purple, lilac, and blue found in flowers "which specially bid for the favour of bees and butterflies." Blue seems to be the highest development of all; but in cases of retrogression we find the direction of change altered. In other cases, where night insects are to do the work of fertilisation, we find white, not as a token of inferiority or degeneration, but as the most suitable colour for that special purpose. Some flowers, fortunately few in number, have a livid red colour resembling that of dead meat, by which (as by their unpleasant odour) they attract the admiring attention of flesh flies.

Luckily, as Sir J. Lubbock notes, and has proved, the tastes of bees and butterflies, the most important among the fertilisers, are akin to ours, not only as to odour and taste, but as to colour: otherwise we may be sure flowers could neither smell so sweetly nor be so beautifully coloured as most of them are, nor secrete so pleasant a product as that from which bees make their honey.

AMERICANISMS.

FARMER JOHN'S SOLILOQUY.

[THIS little poem is worth careful study, as an example of the use of Americanisms in association with true poetry. The expressions seem vulgar and commonplace to English ears, but the language is that of a class, and is not exaggerated or coarsened. Humour and pathos are as effectively combined as in Carleton's ballads.]

1.

I mont as well acknowledge, 'taint no use o' beatin' round,
I've done a heap o' thinkin', plowin' up this faller ground.
An' suthin's been a painin' an' achin' me like sin—
I reekoned 'twas dyspepsy or malary creepin' in.

2.

At last I got my dander up, an' to myself, sez I,
The biggest fool in natur's him that tells hisself a lie:
I've been lettin' on 'tis malary, an' my stummick, when I know
It's my conscience that's a hurtin' an' worryin' me so.

3.

I've been a shirkin' this here thing for thirty year or more,
An' I orto had this shakin' up an' settlin' down afore.
I've been honest fur as payin' goes, not a penny do I owe,
But the kind o' cheatin' that I done, was the kind that didn't show.

4.

My mind goes back to Hanner, when I fetched her here a bride:
No apple-bloom was sweeter, an' she nussled to my side
Like she thought she had a right to, an' could trust me without fear
For the love I never hinted at for more'n thirty year.

5.

There was churnin', bakin', bilin', there was nussin' an' the rest,
From long afore the sun riz 'till he slumbered in the west,
An' when the rest of us was done, an' lollin' round on cheers,
Hanner was recuperatin' with her needle an' her shears.

6.

But when the life was ebbin' from that faithful, patient heart,
I had to face the music—I hadn't done my part;
And I couldn't help a thinkin', watchin' out that weary life,
That there's other ways o' killin' 'xeept a pistol or a knife.

7.

It sounds like sacreligion, but I knew jist what she meant
As I whispered, "Fly to meet me when my airthly life is spent"—
"I'm tired, John, so tired, but I've allus done my best,
An' I may feel more like flyin' when I've had a spell o' rest."

THE DONNELLY CIPHER DECIPHERED.

MANY seem to be impressed with the array of figures advanced by Mr. Donnelly in support of his preposterous cipher system, and supposed to represent the chances against his results being casual. Now that he has disclosed his secret, as he absurdly calls it, giving the key-number of his cipher, the problem is supposed to be reduced to one of probabilities; and although the full value of the odds as he presents them may be regarded as questionable, yet those who are ignorant of the laws of probability imagine that a certain portion of those odds must still exist in favour of the reality of his cryptogram, and a very small proportion would still amount to an overwhelming balance of probabilities.

As a matter of fact, Mr. Donnelly's discussion of the question of chances shows that he is utterly ignorant of the laws of probability. He claims odds in favour of his cryptogram which are absolutely unreal and imaginary. He adds and multiplies these imaginary chances in ways which impress the ignorant (and those ignorant of chance laws are many) with the idea that he is making out a strong case, but impress those who know the laws of probability with the sense of the amazing presumption of the man in pretending to touch weapons of whose use he is absolutely ignorant. That the man who could not understand Bacon's five-letter cipher, even after he had read Bacon's sufficiently lucid account of it, should claim to have discovered and interpreted a cipher which, according to his own account, Bacon had very carefully concealed, was preposterous enough. But that a man whose every remark about the laws of chance shows that he knows nothing about them should claim to urge the calculation of chances in favour of his foolish cipher-theory, is a still more stupendous example of

that blind conceit which crass ignorance alone is capable of begetting.

But now that Mr. Donnelly has been pushed to disclose his key-number 836, he has out-Herodes his own Herodian nonsense (slaughtering those innocents, the laws of arithmetic). He positively attempts to make the final proof of the absurdity of his cryptogram a proof decisive of its validity.

If he had in some way, independent of foregone conclusions, detected the number 836 as a key-number, and thence deduced his five cipher numbers with their modifiers, and if he could then have said "Here are certain numbers which, applied to the folio edition of particular plays, according to definite laws lead to a clear and consistent narrative," men of sense might have been content to look into the matter. The inherent *à priori* improbability that a narrative about Shakespeare should be concealed in a badly printed edition of plays really written by Bacon but attributed to Shakespeare would have outweighed tolerably heavy probabilities of the *à posteriori* sort, and the coarse brutality of the narrative which appeared actually to result from the application of the suggested method would be a very strong argument against the reality of the discovery. Yet it would be impossible to avoid noticing evidence so curious; and if the case were found to be as suggested, antiquarians would be set inquiring who might be the wretch who had so arranged the printing of the folio that it contained evidence injurious to the reputation alike of Bacon and of Shakespeare. Certain that the ill-written, and in parts perfectly loathsome, story could not be Bacon's work, who, with all the faults which marred his greatness, never did aught which could compare with the foul offence imputed, we might imagine some enemy alike of Bacon and of Shakespeare venting his malice and misapplying his ingenuity and industry, to foist into a noble play his own coarse and offensive imaginings. But the interpretation given to the matter by Mr. Donnelly and his following no man of sense could for a moment admit.

Fortunately we are perplexed by no such puzzle. Mr. Donnelly's search began at the other end. He worked on a plan which was bound to give him a cypher system enabling him to find anything he liked in any one of Shakespeare's plays, and in any edition on which he chose to labour. He says, indeed, that those who speak thus of his wonderful work have not themselves shown that such work can be easily done. Not one of them has shown that with a sufficient set of cipher numbers and modifiers, and a sufficiently wide choice as to starting points, ways of counting, and so forth, you can find any story in almost any printed work, though more conveniently in a work like the folio edition of Shakespeare, with its brackets and hyphens and irregularities in the use of both. This, we may readily grant, and rejoice that it is so. A man foolish enough to waste time and ingenuity on work so worthless would be foolish enough to believe in the results he evolved as having a real value. But luckily such folk are few. Were it not for Mr. Donnelly, we might have hoped that they were impossible.

The way in which Mr. Donnelly has worked at his foolish task has been quite obviously such as must inevitably lead him to some such result as he has obtained. With the notion that the occurrence of such words as Francis, Bacon, St. Albones, Nicholas, &c., was to be specially noticed as likely to suggest the key to some cipher, he counts backwards and forwards from all such words, to tops or bottoms of columns, beginnings of scenes, breaks in the printing, and so forth, including and excluding in different counts the words in brackets, counting hyphenated words as one or two, and otherwise varying his count. Failing to find any one number, as indicated in this way, he strives to limit the numbers to which he is thus led to as small a list as possible, the device of "modifiers" helping him to make a list which is really long enough look smaller than it is.

Now it stands to reason that a series of numbers thus long enough to account for the occurrence of all the more characteristic words dealt with in this initial search for cipher numbers, must equally suffice (or suffice even more readily) to lead by the use of equally varied counting methods to any word in the text of the plays which Mr. Donnelly in concocting his narrative might want. Suppose he wishes to find in the play of Henry IV., first part, folio edition, the words "Will Shakespeare is a miserable wretch," or "to that defect." All he has to do is to take a concordance and find where the several words he wants occur in the play, and then to work backwards and forwards from each in succession with each one of his varied methods, numbers and modifiers, until he comes on one count which brings him to a point which he may confidently describe as a natural starting point. He thus successively finds "will" and "shakes" and "peer"—of course he has no trouble with "is" and "a"—but the words "miserable" and "wretch" are not to be found, for the simple reason that, as it chances, neither occurs in the play. This, however, is a matter of no importance. For "miserable" substitute "wretched," and for "wretch" substitute "fellow." Find an effective count for each, and, lo! we have the sentence, "Will Shakespeare is a wretched fellow." We have only, then, to urge the argument from probabilities (confident in the general ignorance of mankind about its laws), asking what are the odds against these six words coming out in grammatical sequence (though we know full well that by our method they, or an equivalent set, were absolutely certain to come out under the actual conditions), and our case is nearly complete. We make any narrative we like in this way, working in whatever our taste, or absence of taste, may suggest, and tell the world that that narrative was found in the famous folio edition of Shakespeare.

I have said that, in this way, our case is "nearly complete." But there is still a touch to be added, by which the confiding public may be more thoroughly gulled. If only it can be shown that the numbers and modifiers we have been obliged to use may all be represented as derived from one, the effect will assuredly be decisive so far as the ignorant many are concerned.

Now our numbers in this particular case are 505, 513, 516, 506, and 523. We have kept them carefully from diverging too widely by the suitable choice of starting points. The difference between the highest, 523, and the lowest, 505, is only 18. If, then, we can in any way find a set of five numbers running pretty nearly equal, but which may by any device whatsoever be able to show differences corresponding to those between our five numbers, we shall be able to reduce these five different numbers to one number. There are only four differences to be accounted for, viz., 8 (513—505), 11 (516—505), 1 (506—505), and 18. Suppose we can find a column, or a page, or a scene in our play in which there are 18 words which are in some way distinguished from the rest—or, rather (for so much we can surely find), suppose we examine every section, be it page, column, or scene, fulfilling this condition—and then inquire whether we cannot in some way separate 8, 11, and 1 of these 18 exceptional words from the rest. The odds are enormously in favour of our being able to do this, though there are other devices to be tried if this one fails. (Some of these, indeed, Mr. Donnelly doubtless did try before trying this one, and finding, after continued search, a case that suited his requirements.) The case occurs at p. 74. (That page is unfortunately not in the first part of "Henry IV.," where Bacon, Francis, Nicholas, and other striking words had been noted; but I venture to say it would have suited

Mr. Donnelly's purpose if he had found it in "A Midsummer's Night's Dream" or "A Winter's Tale.") In the first column of p. 74 the following words are in brackets, "Making the winde my post-horse" and "Under the smile of safety," or *ten* or *eleven* words in all, according as we count "post-horse" as one word or two. There are six hyphenated combinations, namely, "post-horse," "well-knowne," "peasant-Townes," "worme-eaten-hole," "smooth-Comforts-false," and "True-wrongs" (one only of these, the first, falling within a bracket), so that as these 6 contain 14 words, we have a means of obtaining a difference of *eight*, which is one of those we want. We already have *eleven*. Adding these eight to the ten already mentioned we have *eighteen*. Lastly, the word "post-horse," the only hyphenated word within brackets, gives us the difference *one*. Thus we have all the differences we want, besides a few more if we had had occasion for any:—

If all the words including the bracketed words and regarding the hyphenated words as two or three are counted, we have 302 words in the column. By counting the hyphenated words as one each, we reduce the number by *eight*, or to 294. Counting only "post-horse" as one, but leaving all other hyphenated words as two or three, we reduce the 302 words by *one*, or to 301. Omitting all the bracketed words, but regarding the hyphenated words as two or three, we reduce the number 302 by *eleven*, getting 291. And, lastly, if we omit all the bracketed words and count each hyphenated word as one, we reduce the number 302 by *eighteen*, giving 284 words.

Having by this artificial arrangement (to which, were the truth known, we have been forced after multitudinous trials of more natural ones) obtained five numbers differing from each other by the required numbers, we make a fine show by setting these five numbers under the other five already known to differ by the self-same amounts (for what else were we looking?), and showing that addition gives equivalent totals (as, of course, it cannot fail to do), thus—

302	294	301	291	284
505	513	506	516	523
807	807	807	807	807

We might now describe the number 807 as the master number or cipher-key. But it happens that there is a "modifier" 29 as yet not accounted for, which we may as well work into our cipher-key. What is to prevent us from adding 29 to 807, and calling 836 the master number of the cryptogram? Nothing except the necessity of first finding the number 836 somewhere or other. But we can find it a dozen times over, if we only look for it with sufficient resolution. If we cannot get it in a page or scene, we can take some word which we may regard as striking—"found," for example—and counting backwards and forwards 836 words from that with suitable selection of the method of counting (that is including or rejecting bracketed words as may be convenient, and also as may be convenient counting hyphenated words as one or two, we are bound to come out in one or other of at least eight methods of counting available, at some point which we may insist on regarding as obviously an intended starting-point. If we find that by leaving out bracketed words and counting hyphenated words we can reach a convenient starting-place, we can then find how many words the same starting-place will give if bracketed words are all counted and hyphenated words dealt with as if there were no hyphens. Say the number is 900; then we can find some other use for this number, and we can, moreover, make quite a point of the remarkable circumstance that 900 exceeds 836 by exactly the number of bracketed words and of hyphenated words counted in one case to make 900 and left uncounted in the other to make 836. All this will be very impressive—to the reader, at least, who has been deterred by the array of numbers from paying any special attention to the way in which the numbers have been obtained. Anyone who has attended will see that nothing else could happen.

But while Mr. Donnelly is very careful to hide from his followers the simplicity of the plan by which he has been able to work his own self-reading narrative into the play selected for defilement, he not less carefully avoids the discussion of the overwhelming difficulty of the task he supposes Bacon to have accomplished.

The very ease of Donnelly's task results from the complexity of the system he imagines, and the consequent diversity of the paths of interpretation open to him. Yet he would have us believe that a long story has been interwoven in this most complicated fashion into a particular edition of a play which had been already *five times* printed. The folio text was printed from that of the fifth quarto, published in 1613. Now if any one will examine that quarto, and conceive himself planning a reprint with a story to be woven in on some complicated cipher-system, without departing in any essential respects from the quarto edition, he will in a few minutes perceive that the task would be not merely difficult, it would be absolutely impossible. If Bacon besides his own undoubted mental powers had possessed the creative power of a Shakespeare, while instead of being essentially unmathematical he had possessed the combined mental powers of all the mathematicians who have ever lived, even then had been hampered by the conditions imagined by Mr. Donnelly, he could not have wrought a sentence of twenty words, nay, nor of ten or five, into an edition differing so little from the fifth quarto as does the folio text of "Henry the Fourth." It is one thing to puzzle out a cipher story from a sufficiently voluminous collection of words; quite a different and an altogether more difficult thing to bring a cipher story into a poem, play, or other definite literary work, without interfering with its congruity. But this last task, which many, I find, imagine to be all Mr. Donnelly attributes to Bacon, would be child's play compared with the task of so arranging the printing of a new edition of a work already published that a cipher story should be included in it, even one of the simplest sort. That a man like Bacon would devote ten minutes of his valuable time to an attempt of the sort, when one minute would convince him of the impossibility of the task, would be an absurd supposition, even though the story to be wrought in were of the utmost importance. That he would think for a single second of working in the heap of imbecile nonsense attributed to him by Mr. Donnelly, no one but a madman could imagine.

Transmigration of Souls.—Father Alcott used to say that he remembered having lived previous to this life. The Hindoo believes in his past as we believe in our future. This life, to a Christian, is probation; and that is the way he accounts for the evil in it. It is not perfect, but it is preparatory to the perfect. On the contrary, the Oriental says the evil of this life is the consequence of sin in a previous life, and it is therefore to him the real hell. His object is to escape from it as something that ought not to be. He is in prison because of the past; the Christian fears he will fall into prison hereafter. Both systems involve considerable moral influence, and, it is probable, prevent a vast amount of wrong-doing. But when we undertake to hinge together two lives, there is considerable liability that any system will fall into the habit of placing undue value on theories concerning the unknown. Father Alcott must have had the advantage of a remarkably good memory. Will the Occidental in the future life have no better recollection of the present than the average Oriental has of his former life? In the meantime let it not be forgotten that the Apostles' Creed associates the life everlasting with the resurrection of the body. The faithful must not feel free to reject this and accept that part of the Christian creed (*vide* Pearson on the Creed).—"The Future Life."

SPECTRAL MANIFESTATIONS.

IN the March number of Knowledge there is an article entitled "Have Ghosts been Seen?" in which the writer describes various forms and instances of "Spectral Manifestations," and deplores the inability of science to account for them. The article in question describes these phenomena as being presentiments that something of a dreadful or most impressive nature has affected a dear friend or relative, and that they are almost always, if not invariably, confirmed by the event; moreover, that these phenomena are unusual. It must be admitted that these strange visions mostly terminate in accident, sickness, or even death; but the writer of this knows two or three cases where the ghostly visitor was the bearer of good tidings.

If these phenomena were limited to dreams and unusual noises, the difficulty of solving the mystery would not be so far from our reach, as a too active brain would in most cases be accountable for the former, while the latter has been ascribed to a defect in the brain in connection with the aural nerves; but when we come to "Spectral Manifestations," how are we to account for them? The object of this article is to suggest that "animal magnetism" is the agency through which we are able to perceive these spectral manifestations. Nature has given five senses to man generally, namely, sight, touch, hearing, smell, and taste; but to some she has been more lavish and has endorsed them with what is commonly called a sixth sense. This sixth sense is, to a certain extent, beyond explanation; the nearest approach we can make is to suppose it a higher development of some of the ordinary senses, such as touch and hearing. Persons endowed in this way are extremely sensitive. They can often perceive, if placed in a dark room, the luminous flames or scintillations from the poles of a magnet, or from the extremities, especially the fingers, of any one possessing a highly magnetic body. These persons must not be mistaken for cataleptic patients. The subjects we have to deal with are healthy both in body and mind. The most important feature of this extraordinary sensitiveness is that its possessors are so mediumistic for mesmerism. Now let us see what mesmerism really is.

Mesmerism, or correctly magnetism, is artificial somnambulism, the latter being the natural force—hence if we mesmerise a man we make him somnambulistic, but at the same time subservient to our will. Science and experience have taught us that somnambulists do not use their eyes in the ordinary sense when in this magnetic state—that is, as reflectors; the optic nerves must be requisite, but then seemingly in conjunction with others.

These spectral phenomena are unusual; at least, we only occasionally hear of them; equally rare are these cases of persons so specially gifted. Does it not, then, appear feasible to contend that these said persons are the only ones that can see "spectral manifestations"? If it is such an easy matter to influence their minds, and almost their entire systems, when in the same room, may it not be equally possible to manifest the same power from a distance. Again, when these visions appear, there is usually something sad happening to one dear to us, and that solicits sympathy. That is what these sensitive persons can "feel"; they instinctively know that this friend, say, is in trouble, and their power of sympathy is so great that they can often feel the pain as acutely as the individual afflicted.

If, then, through the agency of some magnetic power it is possible for certain specially gifted persons to be cognisant of a friend's suffering—which may be occurring hundreds of miles away—it must be the same force operating on other nerves that enables these same persons to see "spectral manifestations."

Charles E. Cowan.

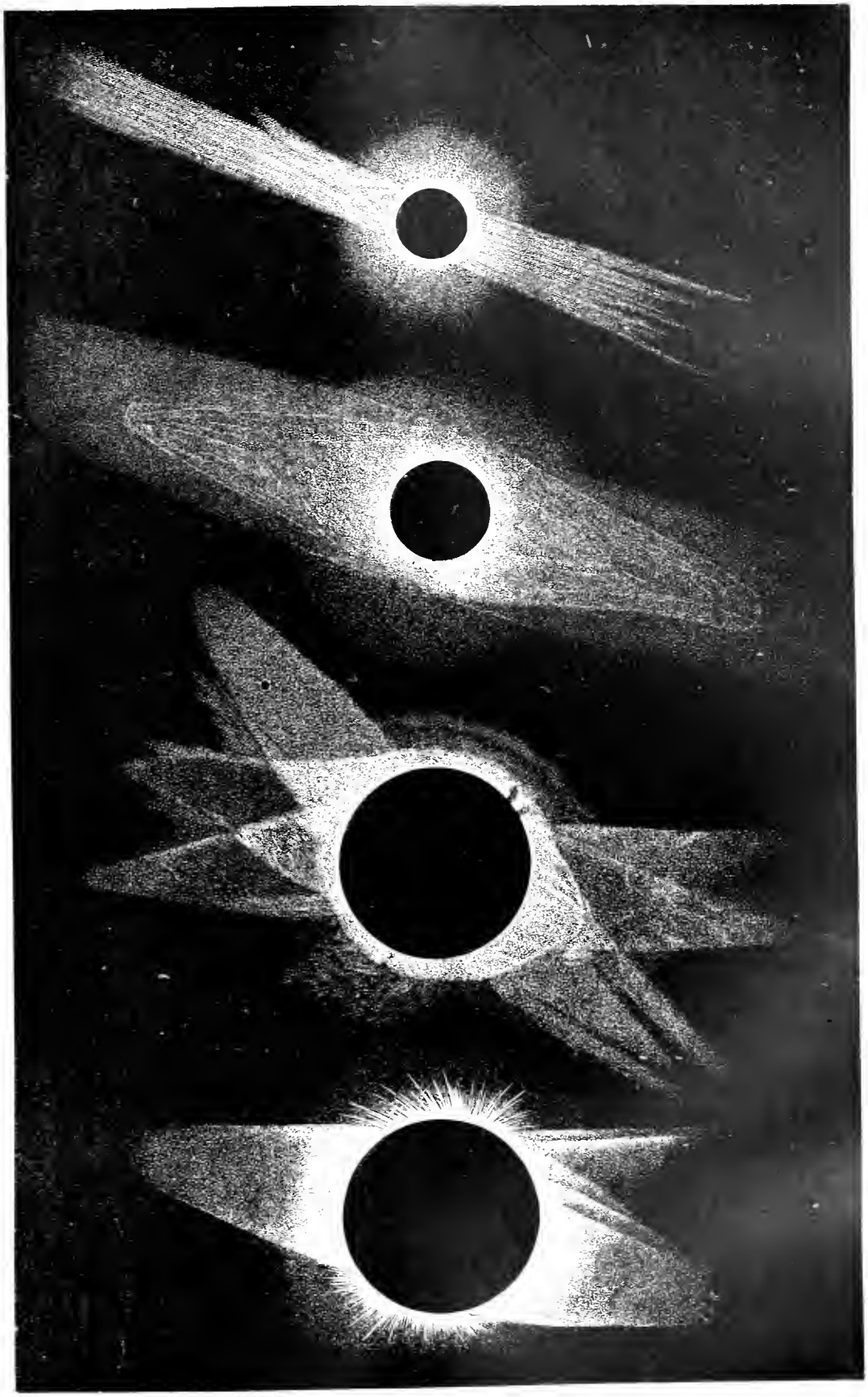
NOTE ON TOTAL SOLAR ECLIPSES.

I HOPE European astronomers will not waste time and money in attempting to visit North-Western America to see the eclipse of January 1, 1889, for I believe that only disappointment is likely to result. It is practically certain that nothing worth knowing can be added on this occasion to what has been learned under more favourable conditions. For the eclipse will last but a very short time, and the sun will be very low at every American station.

I may take this opportunity of recalling the valuable results obtained during the eclipse of July 29, 1878, when observations were made under favourable conditions from lofty stations. Amongst other such places Pike's Peak in Colorado was occupied, and at heights ranging from 5,000 to 10,000 feet above the sea-level observations were made which served to prove, what had already been recognised by the more thoughtful, that the visible extension of the corona depends almost wholly on the clearness of the air through which the region around the eclipsed sun is observed.

The greatest extension of the corona was observed by Professor S. P. Langley, whose drawing of the corona (made from a station on Pike's Peak, about 10,000 feet above the sea-level, is shown in fig. I. of the accompanying four. It is to be noted, however, that he observed the coronal extension on the right first; he next turned to the left side, where the extension was greater, amounting to six diameters of the moon; he then looked around for rays, perceiving none; and finally he looked again carefully at the left side, and found the extension to be now twelve diameters on that side. He felt that his eye was at this time only beginning to be in the right condition for recognising the delicate light of the long radial streaks, and adds that "the twelve diameters through which I traced" the streak on the left "*were* (I feel great confidence in saying) *but a portion of its extent.*" (The italics are his.) It is clear that the inferior extension of the ray observed on the right corresponded with the less sensitive condition of Professor Langley's eye when he looked at that side of the corona. It will be observed that he assigns to it a length of more than four diameters, the ray on the other side having an apparent length of six diameters, as seen afterwards, and going to a length of twelve diameters later. Had he been able to look at the left side later he would doubtless have found, like Newcomb, the extension on that side as great as on the other. Of the coronal wing he did observe, he says, "the central part was brighter than the edges, which were so diffuse as to make the determination of its boundary difficult. It was not so absolutely structureless as the zodiacal light, perhaps, and it appeared longer in proportion to its breadth than that, otherwise I should compare it to the zodiacal light with more confidence than to anything else.

Several interesting views of the corona were obtained on this occasion. Professor Newcomb, hiding by means of a disc set on a pole a circle 1° in diameter (with the moon in the middle), was able to trace the corona in two long extensions, nearly coincident with the ecliptic, to a distance of about 6° from the disc on either side. They looked, he says, very like the zodiacal light on a reduced scale. Six degrees from the disc would be $6\frac{1}{2}$°



Drawings of the Corona, July 29, 1878.

I. Prof. Langley. II. Prof. Newcomb. III. Mr. Denison. IV. From the Photographs.

from the disc's centre, or at the sun's distance more than ten millions of miles. His drawing is reproduced in fig. II. In comparing it with the others it must be remembered that the black disc is not the moon, but the circular screen having an apparent diameter of 12° and nearly twice the moon's.

Mr. Charles Denison's drawing of the corona (fig. III.) is interesting as indicating the effect of perspective. We see from it how the overlapping of the luminous tongues of the corona produces such shapes as had seemed perplexing in Liais's drawing. The two well-marked star-pointed radiations seen on the left (with apices about two-thirds of a diameter from the moon's edge) are seen not to indicate any actual radiations having these definite shapes, but to be produced by the overlapping in the visual field of three much longer radiating beams. We may infer that in all probability these longer beams are themselves in turn produced by the overlapping of beams longer still, but too faint to be separately discernible. It will be observed that as thus interpreted the several outlines of these pointed beams are in all cases real; what is unreal is the association of two outlines which really belong to different streamers into the apparent outline of a single-pointed beam.

We see no indications of the inner set of pointed beams in fig. IV., which represents the results of photography as employed at various stations during the eclipse of July 1878. From this we may infer that the eye was more sensitive to slight differences of luminosity in the coronal beams on this occasion. The absence in the photographic picture of some of the beams shown in Mr. Denison's drawing indicates their relatively small actinic intensity. On the other hand, the delicate curved streaks seen over the parts of the moon's limb between the long streamers are much better shown in the photographs than in most of the drawings.

AN INTELLIGENT CAT.*

MISS KITTY is a favourite member of our family, and she is possessed of so many graces and virtues that I am glad to bear witness to her worth in a brief biography. She is an humble creature, but she lives up to the highest capabilities of her nature, and a careful study of her ways has convinced me that the "godlike reason," of which we assume a monopoly, does not go altogether upon two legs, but is shared, in a greater or less degree, by our four-footed companions.

When she came to us at first Kitty was a little waif, timid and shy, and scarcely four weeks old, and her terrified look, as she crept out from underneath the verandah of our country house, told plainly that she was conscious of having come into a world where cats got far more kicks than caresses. This was but natural, for only the day before she had seen her mother slaughtered by a brute of a boy, and had herself escaped merely because she was too young to render her peltry of any value. We gave her food and spoke kindly to her, but it was days before we could lure her into the house, or induce her to accept our caresses. She would start at the slightest sound, and she wore a look of constant fright, as if the tragedy of her mother's death was continually before her. Gradually, however, the terrible vision seemed to fade from her memory, and she became very playful and affectionate. She would climb upon our laps and our shoulders, and putting her soft cheek to ours, would caress us most fondly. Her favourite station during the day was on my writing table, where she was accustomed to curl herself up and, when awake, to watch the movement of my pen as it glided over the paper. She did not appear to understand this at first, but she very deliberately proceeded to investigate the phenomenon. After watching it one day for a time, she reached out her paw and touched the penholder. I kept on writing, and this, I suppose, gave her confidence, for when her paw had followed my hand once or twice across the sheet, she clutched the pen herself and attempted to go on with the writing. The result was a huge blot upon the MS., at which Kitty gazed aghast for a few moments; then, giving me a sad look and uttering a plaintive wail, she again seated herself near by and looked on in silence. Daily she came upon my table and watched my proceedings, but never again did she volunteer to aid me in the work of composition.

Thinking to arouse Kitty's artistic sense, I one day placed before her a book filled with engravings of animals. She regarded the strange creatures for awhile with some interest; but when I turned the page to one of the cat kind, she gave her head a peculiar toss, by which she expresses contempt or disapprobation, and silently walked away, thus plainly intimating that she could distinguish between the sham and the real. Her strongest admiration was for her beautiful self, and she was, and is, the perfection of feline beauty. She has a full, shapely head, a rounded, graceful form, large, dark, speaking eyes, and a clear black and white coat, as soft and glossy as silk. While still so very young, she never tired of gazing at herself in a glass. One day I set a small toilet mirror upon the floor, so that she could see her reflected image. She gazed unconcernedly upon it for a few moments, but as soon as she observed that the kitten in the glass responded to her every movement she opened her eyes wide with astonishment. Then, looking up at me inquiringly, she proceeded to investigate the toilet-glass, walking round and round it, and now and then tapping its wooden back with her paw. When she had apparently become convinced that it did not conceal her own counterpart, she again set herself down before it and began to smooth her coat and stroke her whiskers, all the while keeping one eye fixed upon the reflected kitten which was performing the same ceremonies. At last she fell asleep, and I set the glass away upon an upper shelf in my library; but she no sooner awoke than she came to me, looked up at the mirror, and by a pleading mew asked me to place it again upon the floor. This I did day after day to the great delight of Miss Kitty, who would sit before it for an hour at a stretch, prinking and pruning herself like any human coquette. One day, having a visitor, I failed to respond as promptly as usual to her request for the glass, and she suddenly darted into an adjoining room, where, half an hour later, I found her perched upon the top of a bureau, and surveying herself in the larger glass that hung above it. She had detected the likeness between the two mirrors. After that she never petitioned me for the toilet-glass, for one of her commendable traits is never to ask of another what she can do for herself. But even now, in mature cathood, she exhibits this feminine vanity. Often I come upon her posed before a mirror, and I think no four-footed creature ever assumed quite so many airs as she did a little time ago, when she first saw upon her neck the reflection of a gorgeous leather collar.

Until Kitty was about three months old we considered her too young to profit much by instruction, but then my wife set about giving her a little cat-education. She had no difficulty in teaching her to ask for her dinner by a rub against the table leg, and to respond by a wag of the tail to almost any simple question. Very soon the questions, "Do

* From an article by Edmund Kirke in the *North American Review*.

you love me?" and "Are you a good little Kitty?" were uniformly answered by an energetic wave of her caudal appendage. Her wants from the first she spontaneously made known by a pull at my wife's dress, or by a peculiar mew which has a wonderful likeness to human speech. From her first domestication she has slept in our chamber, and if now and then shut out of the house when it was locked up for the night, she would climb upon the verandah which runs along the front of our summer residence and tap upon our window for admission. Sometimes she did this at midnight, and we, being fast asleep, would fail to respond very promptly to her summons. In this event she would, on being let in, stamp her foot upon the floor and scold away at us for fully five minutes in a peculiar tone, a kind of mutter that was both rapid and decided.

Among other things which my wife at this time taught the feline lady was to turn somersaults upon the floor, to play at hide-and-go-seek, and to run in a hurdle-race around a large room. This last used to come off in the library, the hurdles being piles of books placed at irregular intervals, and Kitty vaulting over them in a race around the apartment. At first she was lured into this performance by a string drawn rapidly across the book-piles, but soon my wife was able to omit this incitement, and get Kitty into the race by merely giving her the word at starting. She enjoyed the performance greatly, and invariably asked for it every evening after supper until she became a mother and engrossed in the duties of maternity.

She was about a year old when this happened, and it has seemed to develop her nature wonderfully. Ever since she has given clear and striking proofs of that ability to combine means with ends and that power of deducing one result from another which we term "reason." Her memory also has grown remarkably clear and strong, as a little incident will illustrate. Some ladies whom she had not seen for a whole year called upon us one day during last summer, and she at once greeted them with every sign of recognition. The hurdle-races had been for a long time discontinued, but on our visitors expressing a desire to again witness the performance, we ranged the books around the room, and, my wife giving the word, Kitty at once vaulted over them with all her old agility. She had made two or three circuits of the apartment, when she suddenly paused as if a new idea had just struck her. Her four kittens, now about four months old, were in the room, and they had paused in their play to witness the performance; and now Kitty called them to her, and addressed them in an energetic manner. At first they did not seem to comprehend what she wanted, but, taking her idea, my wife produced a string, and calling "Little kitties," proceeded to draw it across the books in the old manner. Instantly the kittens were after the string, and Kitty was after the kittens, going round the room in flying leaps, and urging them forward with cries of encouragement. Once in a while one of the little fellows would dodge the books, or fall out of line, and then his mother would pause in her flight, and, cuffing his ears, force him again into the race. Soon my wife withdrew the string, and then they went on without it—five cats chasing one another in a hurdle-race around the room, while we and our guests were shouting with laughter. Often afterward the performance was repeated, and always at its close both the cats and the kittens would come to us for some mark of our approval.

Kitty has exhibited in a high degree the wonderful instinct which guides the cat in training her young, but she has also shown in their education an adaptation of means to ends which, with neither cats nor men, is instinctive. For instance, she would bring live mice and squirrels into the kitchen, and, setting them free, would set her kittens to hunting the creatures. This was instinct, but reason came in when the mouse or the squirrel got away, and hid behind some article of furniture, where neither cat nor kittens could get at it. Then Kitty would ask my wife or the servant to remove the article; but if it happened to be too heavy for a woman's strength—and it usually was a large cupboard—she would come directly to my "den" in a remote part of the house, and insist upon my going at once to the rescue.

As they grew older Kitty's progeny took to climbing, and occasionally one of them would push himself upon an upper branch of some tall tree, whence it dared not come down, and where Kitty knew she could not venture her own weight in safety. On such occasions she would rush into the house and appeal to my wife, who would call our farmer's boy, and send him up the tree to rescue the endangered kitten. Once on a time my wife could not be found, and, after searching for her in vain, Kitty went herself to the barn, called the boy, and led him to the tree up which was the venturesome kitten. The little fellows thought it rare fun to hide away in the near-by woods where their mother could not find them. To her cries for them at such times they would pay no sort of attention; but they never heard my wife call "Little kitties—come home, little kitties" but they came trooping toward the house as fast as their little legs could carry them. Observing this, Kitty never failed to ask her aid in such circumstances. On one occasion all four of the kittens had disappeared, and the cat and her mistress had for a considerable time searched for them without success in the neighbouring bushes and undergrowth, when suddenly Kitty sprang up a tall pine to its very top, whence she could see all the surrounding woods. In a few moments she was down again, and then, making to my wife a peculiar gesture of the head by which she indicates that she desires to be followed, she led her to a considerable distance in a direction never before taken by the kittens, and there, perched upon the top rail of the farm fence, were the four runaways.

Upon another occasion, when the servant was absent from the kitchen and my wife was upstairs in the most remote part of the house, Kitty came bounding up to her, with an urgent demand to be followed. She led her directly to the kitchen, and there was a strange man who had no business on the premises. A like intelligence Kitty showed one dark and stormy night, when we had inadvertently gone to bed leaving her out of doors. About midnight she came to my wife's bed, woke her up and beckoned her to follow. She led her down to the dining-room, where the glass door, leading out upon the verandah, stood wide open. Observing this, she had entered by that way, instead of coming, as usual, to our chamber window, and, knowing that the door should not be left open, she gave my wife this notice before retiring to her nightly quarters. And this reminds me that though Kitty often makes demands upon me in the daytime, she never wakes me at night, however great may seem to her the emergency, and this she does without having the least instruction on the subject. Making not the slightest noise, she comes to my wife's side and rouses her by springing lightly upon the bed and gently stroking her face, but she lets me rest in quiet. She has the good sense to know that a man who works with brain or hand all day should be left at night to enjoy unbroken slumber. I could relate numerous instances similar to the foregoing, but I have now space for only a sad catastrophe that befell Kitty and her little family.

The four kittens had grown to be nearly as large as their mother, when Kitty had another litter—three little fellows. Soon afterwards a distemper appeared which swept away nearly all the cats in the neighbourhood, and one after

another it carried off the four kittens. They were taken at first with a strange drowsiness, then, after moping about for a short while, they went off into the woods to die. This had happened to all the four, when Kitty was herself taken with the distemper. Her younger kittens were below stairs, and the first intimation that we had that she was seized with the malady was the discovery that she had carried the little fellows up to our chamber, and deposited them in the drawer of a bureau which happened to be open. We had been fearful of this, and only the day before had asked medical advice against such an emergency; and now, with the medicines in our hands, we hastened to the woods, where we knew she had secreted herself. After a long search we found her hidden away in some undergrowth, in a comatose condition, and scarcely conscious, but still able to give a slight wag of the tail when her mistress asked, "Are you a good little Kitty?" We then gave her the proper remedies, and bore her back to the house, where she was given every possible attention. By constant care we managed to keep the breath of life in her body; but she refused all food, and for fully ten days lay in a lethargic condition. Meanwhile her kittens had to be drowned, for they were too young to take any nourishment except from their mother. At last she came to herself, and then the first thing she did was to go up to the bureau where she had deposited her kittens, and the look of distress that came upon her face when she discovered they were gone was almost human. She mourned for them for many days, and she would not be comforted.

After this event Kitty would scarcely let her mistress go out of her sight. Ever since she has clung to her with a strange tenacity, and day by day has shown for her a constantly growing affection that is most remarkable. It was on this account that we this autumn brought her with us when we moved into our winter home, instead of leaving her, as heretofore, with the farmer at our summer residence. She has adapted herself to her new home, and to the change from country to city life, with a readiness that entirely disproves the common opinion that cats are more attached to places than to persons.

LIFE IN OTHER WORLDS.

IT is not generally noticed, I think—or rather it is not generally remembered—that the question of life in other worlds belongs altogether to modern times. I do not say it belongs to modern science, for in reality it is not a scientific question at all, belonging rather to the domain of philosophy than of science. But it never was discussed as a question either of science or philosophy until some three hundred years ago. Before that time men no more imagined that besides our earth there may be other worlds, like her the abode of thousands of races of animal life, and myriads of forms of vegetable life, than they conceived the possibility that the earth, the heavens with all their thousands of stars, with the sun the glory of day and the moon the light of night, were intended for any other purpose than to adorn and benefit the earth. The supposition that among the orbs in the heavens there might be some akin to the earth in character and dimensions, or even much larger than her, while the fixed stars themselves might belong to an even higher order in the scale of creation—being suns like our own and the centres of families of worlds akin to the solar system—would have seemed wild and fanciful in the extreme.

We find the same ideas in this respect, whether we examine those parts of ancient literature which have been gathered together into a book regarded as sacred, or those other portions which are called profane—the recondite reasons for which distinction do not concern us here.

In Hesiod, Herodotus, and Thucydides, Virgil and Horace, as in the ancient Egyptian, Assyrian, Indian, and Chinese records, we nowhere recognise a trace of any idea that our earth is not the only world. Repeatedly we find references to other races of beings than men, gods and goddesses, beings angelic and beings demoniac, unseen beings having their abodes in the mountain, the sea, and the rivers, dwelling in trees and in animals; in fine, wherever the lively fancy of the child man could conceive them. It was not for want of imagination that the ancients failed to picture other worlds in the planets and other suns in the stars; it was simply that they knew of nothing to suggest the thought, and in like manner in the various books, both of the Old Testament and the New, there is no suggestion of other worlds. Sun and moon are pictured as made for the earth's sole benefit. "He made the stars also" for the earth alone, "to be for signs" (in the astronomical sense) "and for seasons and for days and years." The possibility was not even thought of that our earth is an orb moving in the skies of other worlds as Jupiter and Saturn, Venus, Mars, and Mercury move in ours, or that the sun which rules our day is one among those other suns, "the stars also," which shine in the skies of the thousands of worlds within such distances from our system that our sun is as a star for them.

I know it has been suggested that where, in the Bible, reference is made to "the host of heaven," the suns and worlds peopling space may be referred to. But the best proof that this is not so is that the words were never so understood, nor was any suggestion ever made that they should be so understood, until discoveries had been effected of which neither the writers nor the readers of those words in ancient times had any inkling. It is but a feeble way of defending those ancient writers from purely imaginary discredit for not knowing what they could not know, to maintain that they could not write so as to be rightly understood. Manifestly, however, their writings corresponded (in this respect as in all others) with the condition of knowledge as it existed in their day.

It could not be until the Copernican theory had been established that the idea should begin to grow upon the minds of the more thoughtful that since our earth is but one of the sun's family of planets, she is probably but one among God's worlds. Of course this idea ought logically to have found favour at once. Yet I apprehend that no one who has noticed how slowly even in these scientific days the consequences of newly discovered truths are appreciated, will be disposed to wonder that many years passed before even Copernicans began to admit the doctrine of other worlds than ours. It was not until the power of measuring the solar system, and comparing the various planets together and with the earth, that men began clearly to perceive our earth's position as but one among a family of orbs, some of which, indeed, are smaller than herself, but two of which could be seen even in these days to be very much larger. Even if they had supposed our earth to be *primus inter pares*, they would still have been obliged to regard the others as in all probability akin to her. But when she was perceived to be neither first nor last in size and importance, the more thoughtful perceived the absurdity of regarding her as the only one among the planets which is the abode of life. An insect living in a tree in the midst of a forest might as reasonably think his tree the only possible home for insect race.

As astronomers penetrated more and more profoundly into the depths of space, the belief in other worlds and other

suns naturally became more certain and more general. As they studied the members of the solar system with the telescope, they began to recognise features of resemblance between other planets and the earth, which confirmed them in the opinion that all the planets are worlds. With growing knowledge the doctrine of life in other worlds grew in favour and in interest. Christian Huyghens spoke earnestly in its favour. Fontenelle was enthusiastic in urging it; writers like Drs. Dick and Chalmers gave to it an almost religious colouring; and at last when Dr. Whewell, after advocating the doctrine of other worlds in his contribution to the "Bridgewater Treatises," called it seriously in question in his "Plurality of Worlds," the venerable Brewster (Sir David of that ilk) was moved in his wrath to denounce the Master of Trinity as one who strove to shake men's faith in a doctrine which he described as "the hope of the philosopher and the faith of the Christian."

The subject had reached this position when I was led to take it up, not—let me admit now—for its own sake, but as a convenient subject with which to associate the results of scientific researches which I could in no other way bring before the notice of the general reading public. That the subject, though not scientific, and though for my own part I had been rather wearied by the over-warm discussions of Whewell and Brewster, has an attraction of its own, is well shown by the circumstance that though I had a strictly scientific purpose in writing my "Other Worlds Than Ours," I became quickly interested in the philosophic problem with which I had ostensibly undertaken to deal.

I think I was the first to recognise the change which the researches of the last half century or so should introduce into our ideas respecting other worlds. So long as men recognised the past of the earth and of the solar system as measurable by a few thousand of years, it was natural that they should regard the planets as simply a family of worlds, all in the same stage of world life. Their view of the solar system may be compared to the view we should take of a plantation known to be but a few years old, in which we should expect to find no marked varieties of age or condition among the trees—supposed all to be of one kind. But precisely as one who approached a portion of "the forest primeval" would expect to find, even among trees of the same order, all varieties of age, the seedling, the sapling, the tree growing old and decayed, and the dead and withered stump, so, recognising, as science now does, that the age of the solar system must be measured by tens if not by hundreds of millions of years, we must admit the probability, one may fairly say the certainty, that we shall find in that system every stage of orb life—from those orbs which being very large and massive have passed through but a small proportion of their exceedingly long lives, to those which being much smaller have passed to their mid career or onward even through the whole of their lives to the condition of planetary death.

I did not myself perceive this truth as distinctly as I have just presented it. A long time passed before I saw that the larger orbs must be the younger and the smaller the older, unless (as in some few cases may have happened) some great difference in the time of beginning orb life may have caused a smaller but later-starting orb to be at this present time younger than a somewhat larger planet. (Saturn, for example, appears to be younger than Jupiter, though being smaller he might be expected to be somewhat more advanced in planetary life; but in the fulness of time, I know not how many millions of years, Saturn will advance beyond Jupiter in development, even as our earth has long since passed both, and as the moon has long since passed the earth.) When first the thought presented itself to me that in the solar system there must co-exist many different stages of orb life, I saw it simply in that general way, and had no idea of the harmonious series into which I should later be able to arrange the various orbs attending on the sun.

So soon, however, as the connection between size and relative age is perceived, we see at once that the various orders of bodies within the solar system can be classified according to the several stages of orb life which they may be expected to illustrate, and that as a matter of fact they severally present the characteristics which we are thus led to expect. The largest orb of all—the sun—represents the first or glowing vaporous stage, the babyhood of orb life; the giant planets, Jupiter and Saturn, present all the characteristics of the second or fiery stage; the earth certainly, and Venus probably, present the characteristics of mid life; old age is recognised in Mars and Mercury; and, finally, the death stage is presented in the arid and desolate surface of our companion planet, the moon.

For a long time I was content with the advance (for such it seems to me) beyond the old-fashioned view. So soon as we recognise that the life-bearing stage is but a part, and it may be but a small part of an orb's career, we find a new meaning given to the universe of suns and solar systems. An extension of our ideas in regard to time, in some degree akin to the extension which they had already received in regard to space, is thus obtained. Doubtless it was a grand and impressive thought in old times to recognise each orb in the solar system as in the fulness of its life-bearing career, and to extend the same idea to the star-depths in such sort that each sun might be regarded as the centre of a solar system, each member of which, save the central orb, is now an abode of life. Yet is there in this view, which presents the whole universe as the scene of omnipresent life, a certain element of bitterness. *Surgit amari aliquid.* Before those multitudinous orbs became the abode of life there would have been universal lifelessness; and after they cease to be inhabited or fit for habitation (and no created thing can endure for ever) there will be universal death. But according to the view which I have suggested (the view, be it remembered, to which all the evidence points), though the number of habitable orbs be greatly diminished, it yet remains to all intents and purposes infinite, while, instead of regarding the duration of life in the universe as finite, we can perceive that it is eternal in time, even as it is infinite in spatial extension. For if, when we look at any star we infer, from what we know about our own star—the sun—and his family of attendant orbs, that at least one member of that star's family is the abode of life like our earth, at least one has been the abode of life in the past, though now dead like the moon, while at least one, like the giant Jupiter or his brother Saturn, though not yet the abode of life will become so hereafter, then repeating that lesson for all the stars visible to the naked eye, telescopic, or (far past telescopic range) visible in the mind's eye, we may say: There in those depths are millions, ten hundred thousands of millions of orbs the abode of life now, as many that were the abode of life millions of years ago, as many that will be the abode of life hereafter.

But while this extension of the old-fashioned views is impressive in itself and amply justified by the evidence from analogy, sufficient account is not taken of all the features of variety and of actual difference which distinguish planet from planet (even within our solar system) and sun from sun within the sidereal system. It is as though an insect after studying from within its own tree home the various trees thence discernible in the forest, should have come first to the conclusion that other trees besides its own are the abode of life, and next, that some trees are much younger than its own tree home, and may therefore be quite unfit as yet to be inhabited by insect

races, while others are too old, or may even be but dead and withered stumps. This would be a decided advance upon that insect's former view; but it would be insufficient if the insect stopped just there. After a while the more thoughtful among the insect inhabitants of that tree would perceive that among the trees in the forest there were not only many that differed from its own tree home in being older or younger, but many which actually differed from it in kind, never resembling it closely in any one of the stages of their tree growth. The insect inhabitants of the tree would then perceive that trees thus differing from their tree home in nature were not probably suitable abodes for the same forms of life, or might even be obviously and demonstrably unsuited for kindred insect races. Extending to the solar system and its fellow systems the idea thus suggested only as a parable, the life-history of orbs, different orders must in all probability be entirely distinct, even though all pass through the same general stages of orb life.

For instance, the sun, regarded as an orb, is in that glowing, vaporous stage, which, in the earth's case, signified infancy. Yet, as regards his work as a supporter of life, our sun is in the very fulness of his career. He may quite possibly have no other special work to do in orb life; and after he has passed that stage when an orb is still instinct with its primeval heat and glows with its primeval lustre, he may remain a mass of idle matter, not himself the abode of life like our earth, nor any longer nourishing life in other worlds, as he did when in his prime.

Again, it may be that the giant planets, Jupiter and Saturn, are doing the best part of their life-work, if not practically the whole, in the present stage of their career. Unfit now to be inhabited worlds, they may ever remain so; or the time when living creatures could exist upon their surface may correspond to a time when the sun will have lost its light and heat, and when, therefore, existence would be impossible on the surfaces of any one among the giant planets.

We have at least as much reason for supposing that when our earth was in sun-like stage of her career, or later when, in the fiery stage, she resembled Jupiter or Saturn, she did work such as the sun now does, or performed such duties as Jupiter or Saturn may discharge to their attendant worlds, as we have for supposing that when the sun or Jupiter becomes as cool as the earth, they will be inhabited by creatures suitable to the condition which will then exist upon those respective orbs.

With regard to orbs like Mars and the moon, which are old or to all intents and purposes dead, we, doubtless, are justified in assigning to them, as the probable period of their life-bearing career, the time when they resembled the earth in condition more nearly than they do now. Yet, though orbs of both classes probably passed through such a life-bearing stage, it is unlikely, nay, practically impossible, that either can have resembled the earth closely at any time. It is not merely that the duration of the life-bearing stage on our moon, for example, must have been much less than that of the corresponding stage on the earth, but that the various conditions essential to life as we know it upon the earth cannot have existed at one and the same time upon the moon. When the moon's crust was like our earth's in regard to heat, volcanic activity, and so forth, the air and water must have been much less in relative amount, and such life as may then have been present on the moon must have existed under conditions very different from those now existing on the earth. On the other hand, when the lunar atmosphere was as dense as the earth's atmosphere now is, its constitution must have been very different, for that period corresponded to a much earlier stage of orb life; at that time also the moon's surface would have been greatly too hot to be the abode of living creatures such as we are acquainted with on earth

Recognising, as we now do, the general principles at least on which the evolution of animal and vegetable life proceeds, we can infer that even if the first forms of life on Mars, on Mercury, or on the moon were, or those on Jupiter and Saturn will be, akin to those on the earth—which is antecedently unlikely—yet the orders of animal and vegetable life developed on those other worlds could not but be utterly unlike those which, during the many million of years of her past life, have been developed on the earth. Perhaps on a much shorter-lasting planet like the moon the highest orders of life developed were altogether inferior to those developed on the earth. Perhaps on much longer-lasting planets like Jupiter and Saturn much higher types of life will be developed than have ever been developed on our planet. However this may be, whether the best types developed elsewhere have been or will be superior or inferior to those developed on the earth, this at least is certain—they must be very different. Life, animal as well as vegetable, in other worlds than ours, must be infinitely varied.

THE MORDEY ALTERNATOR.

THE machine which is illustrated by the accompanying views is being brought out by the Anglo-American Brush Electric Light Corporation, Limited, for use in connection with distribution on the transformer system. It is one of a new type, and possesses several advantages of practical importance, and it is quite a new departure in dynamos. It is the invention of Mr. W. M. Mordey, and gives

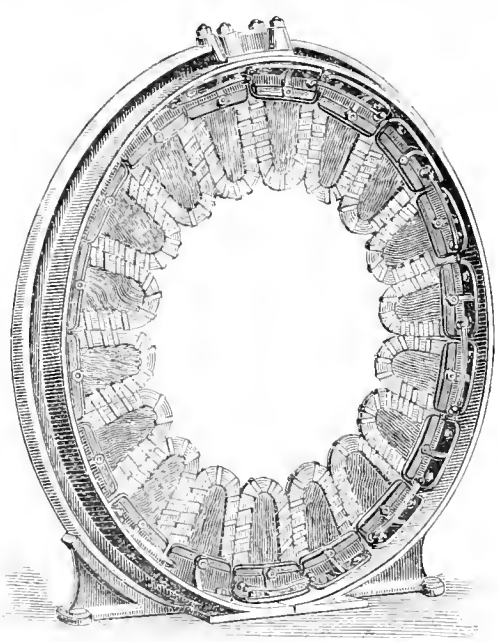


Fig. 1.—Armature of Alternator.

an output of 35,000 to 40,000 watts, the terminal potential difference being 2,000 volts. The speed is 650 revolutions per minute. Fig. 1 shows the armature, which is stationary, and consists of a number of coils of narrow copper ribbon, wound on cores of non-conducting material. Some detached coils are shown. Each coil is bolted at the broad end between two brackets, the ends of the conductor

being brought out through porcelain insulators. The brackets are then bolted to the gun-metal supporting ring, the coils being thus rigidly and securely held in position by metal supports, which in no part come between the poles, and are, in fact, almost entirely out of the magnetic field. By this means eddy currents are almost entirely avoided, any loss from this cause being still further reduced by the use of German silver for the brackets and bolts; the high resistance of this alloy preventing the generation of local currents of more than a very small amount. The gun-metal supporting ring, which is bolted to the bed-plate of the machine, is in two portions, being divided in a vertical diametrical line. These two parts, after having received the coils, are bolted together and to the bed-plate, the field magnet being first placed in position. It will be seen that this design provides ample facilities for repairs. It allows not only of single coils of the armature being quickly and easily removed and replaced, but also renders it easy to take out one half or the whole of the armature. We need not say that it is of the first importance in all electric lighting work, especially for central stations, that the machinery

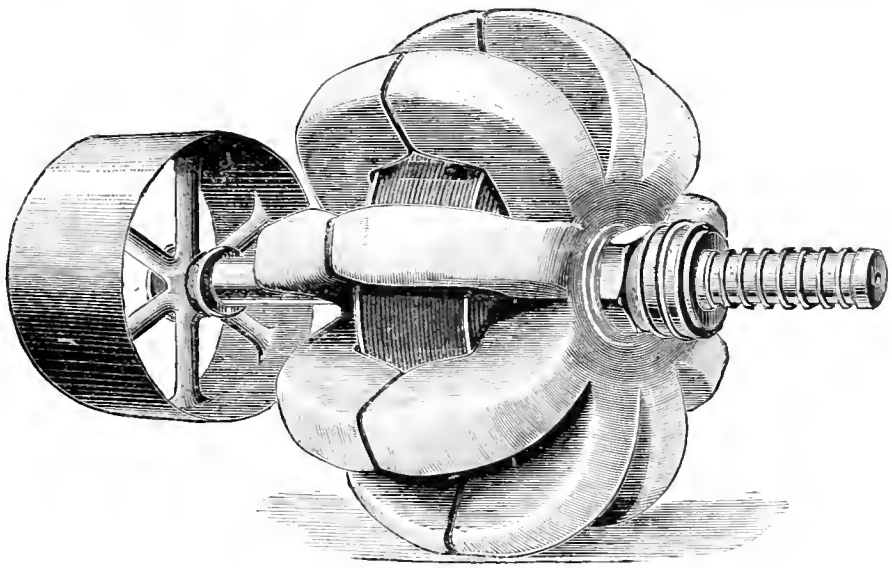


Fig. 2.—Field Magnet of Mordey Alternator.

should be planned, not only with a view to the prevention of a breakdown, but also to permit of any necessary repairs being quickly carried out, and it will be seen that in this armature both these ends have been very satisfactorily attained.

The field magnet (fig. 2) cannot be said to bear any resemblance to any form of field magnet with which electric engineers are familiar. It consists of a single electro-magnet built up as follows:—A short cylinder of iron, through the axis of which the shaft passes, forms the core of the magnet, and is wound with the exciting coil. Against each end of this cylinder is placed a cast-iron piece of peculiar form, which will be best understood from fig. 2. Each casting has a number of horns or arms—nine in the machine illustrated—which radiate from the shaft and central part of the casting, and then bend over, forming nine pole pieces on each side of the armature. These horns on one side, as will be seen, approach within a very short distance of those on the other side of the armature, and in this very narrow polar gap or slit the armature is held, the entire field magnet revolving with the shaft on which it is mounted. The ends of the exciting coil are connected to "collector" rings on the shaft, which are shown to the right of the figure. These may be dispensed with, and the exciting coil as well as the armature may be stationary; but it is preferable, for mechanical reasons, to attach the winding to the rotating magnet. As will at once be seen, this form of field magnet is very simple. A single exciting coil suffices for a machine of any size, speed, or number of alternations. Besides its peculiarity of form, it differs from the usual arrangement in that it has poles of one sign only on each side of the armature; thus the magnetic leakage between adjacent poles on each side is absolutely *nil*, a condition widely different from that of machines having the usual arrangement of alternate polarities, in which the leakage is very considerable. By revolving the field magnet instead of the more delicate armature, safety and steadiness of running are secured, the heavy magnet acting as an excellent flywheel, and effectually neutralising any pulsations due to irregularity in the stroke of the engine. This is a point of some moment where slow speed engines are used. Further, as the parts revolving at the highest velocity are simple solid iron masses of the strongest description (not laminated), not subject to heating, and having no copper wire on or near to expand and fly out, the electrical and mechanical considerations which in ordinary dynamos usually renders low speed advisable do not here apply. The armature being stationary, the coils have to be supported only with a view to resisting the tangential drag of the field. This renders insulation a matter of comparative simplicity, and is of great importance in high tension work, such as this machine is primarily designed for.

The Mordey alternator is shown in its complete form in fig. 3. The field magnet is almost entirely hidden by sheet metal shields, which have for their object the prevention of air disturbance by the horns, which otherwise would act as the blades of a fan, and cause a perceptible waste of power. The fanning action is, however, permitted to a sufficient extent to ensure good ventilation and cool working. The armature terminals, which are not seen in the figure, are at the upper part of the supporting ring. The thrust bearing is adjustable longitudinally for the purpose of enabling the field to be placed exactly symmetrical with regard to the armature.

Fig. 4 shows also the little Victoria dynamo used as an exciter, and a small adjustable resistance, which is all that is required for regulation. The alternator is, in fact, very

nearly self-regulating in itself, as is shown by fig. 5, giving the characteristic of the machine throughout a range of 37,000 watts. From this curve, it is clear that practically

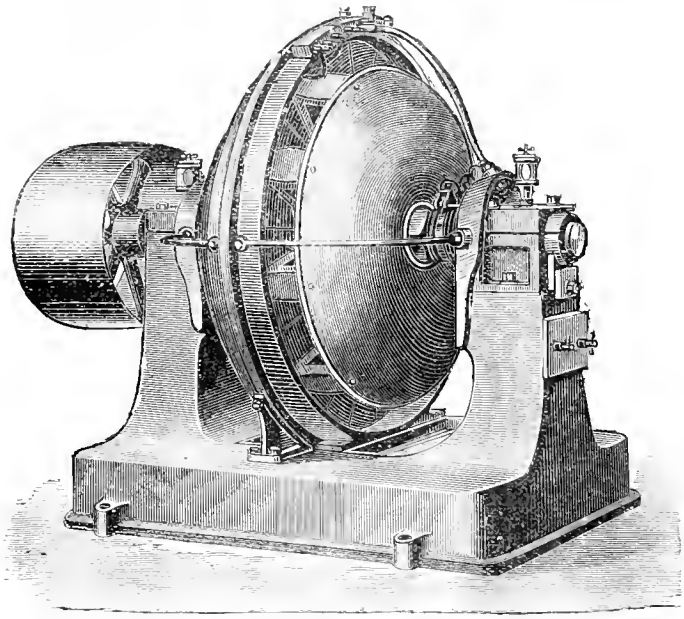


Fig. 3.—Mordey Alternator (Complete).

the whole of the load—or say 600 lamps—might safely be turned off without danger to any remaining lamps, and that probably a large proportion of the load, certainly 50 per

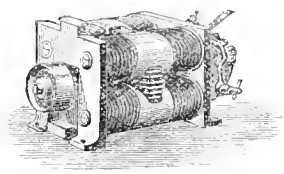


Fig. 4.

cent., could be turned off without attracting notice on the rest of the circuit. It is, therefore, not considered necessary or desirable, except under special circumstances, to provide other than a simple hand regulation at the dynamo

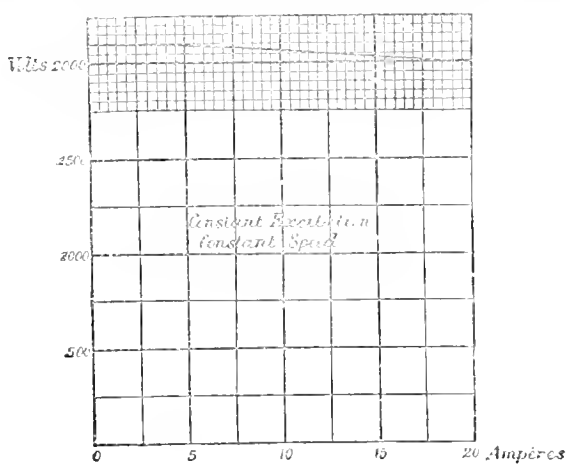


Fig. 5.

for the purpose of controlling the potential difference. Sudden and violent fluctuations of the lights are impossible with this machine, and an occasional touch of the resistance regulator, as the load comes on or off, meets all practical requirements. It is only in the case of machines whose potential curve is a rapidly falling one that it is necessary to resort to automatic control. There is no doubt that by avoiding the use of additional apparatus of this sort the chances of temporary interruption are reduced. By the arrangement of the armature coils it is easy to obtain various combinations if desired. This circumstance is made use of for simplifying the measurement of the potential. Instead of taking the reading across the terminals, which would necessitate the use of an electrometer, or a very high resistance voltmeter, an ordinary voltmeter, indicating to 100 or 150 volts, is placed across one of the coils. The machine is fitted with a special pair of voltmeter terminals for this purpose. We understand that this dynamo of 50 to 60 horse-power—the first of its type—was successfully built directly from the first design, without recourse to any preliminary experiment.

MR. LOCKYER ON THE EARTH'S MOVEMENTS.*

A STRANGE PUZZLE.

MESSRS. MACMILLAN have never been given to the publication of jocular scientific books, or we might explain this work as simply an elaborate jest. We cannot, on the other hand, suppose that, though published in all good faith as a serious work by them, it was intended as a jest by Mr. Lockyer, for he could not wilfully play off such a joke on his good friends, the publishers of *Nature*. Yet he cannot seriously regard this absurd production as a contribution to exact knowledge. It is true his "Elementary Lessons in Astronomy" contained some marvellous blunders, a few of the least preposterous of which were used in astronomical examinations at Trinity College, Cambridge, in the character of "awful examples," and in his "Primer of Astronomy" he made some still odder mistakes—as, for instance, in describing the stars which pass to the zenith of London, which never rise or set at all, as rising and setting "on a slant." But even this evidence that Mr. Lockyer might not be able to recognise the full absurdity of what he has brought out in the book before us does not prevent its being a strange puzzle. For surely some friend, were it only a well-taught schoolboy, might have been able to explain to him that a book which, with an elaborate air of condescension for the general reader, is utterly inaccurate, confusing, and misleading, should not be sent to the printers.

It chances that we have had to conduct examinations of students in astronomy, with the duty of determining who had done best and best deserved certificates or other rewards. In so doing we have sometimes felt appalled at the bewilderment of mind indicated in replies which related to matters explained with ample clearness in the text-books recommended by us, besides being most carefully, and as we had hoped simply, explained by ourselves in preparatory lectures. Well, we find again and again in Mr. Lockyer's book passages recalling answers of this saddening kind—saddening, yet sometimes so ludicrous that we have had to set down the papers we were examining to indulge in prolonged laughter at their absurdity.

Of course the whole book is not absurd. We come across

* "Outlines of Physiography. The Movements of the Earth." By Jos. N. Lockyer. London: Macmillan & Co.

explanations which are perfectly correct, being, in fact, only altered in a few words from an explanation given by Newcomb or Airy, or others who understood what they were explaining. Again, many of the illustrations are excellent, being, in fact, those provided to accompany correct explanations in books worth reading. But the trouble is that the reader, who is also a learner, can never be quite sure whether what he is reading is a correct and well-illustrated explanation borrowed from an able astronomer, or sheer nonsense which he should forget *quam celerrime*.

It is a duty which we owe to the honest student of astronomy to say so much as may keep him from wasting his time over this most remarkable production. We have not time to indicate all the passages which are incorrect or absurd; neither would it be fair to those writers whose correct statements have been repeated, to show how by eliminating such and such portions (all Mr. Lockyer's original work, we suspect) their good explanations would remain (little impaired by verbal changes) with their excellent accompanying illustrations.

The fairest course seems to be to give a few samples, taken absolutely unchanged from Mr. Lockyer's book (though many will find it hard to believe as much), to show that we have not exaggerated either the condescending tone of the work, or the utter inanity of the original (indeed, highly original) matter.

In the following passage, Mr. Lockyer opens his explanation of the apparent motion of the star-sphere:—

> Suppose that in the centre of a lecture-theatre a little globe were hung to represent the earth, the walls of the theatre and the people in it representing the heavens surrounding the earth. In such a case it is clear that the appearances presented would be the same whether the heavens moved round the earth, or the earth itself were endowed with motion. Let us, without making the assertion, assume that the earth does move. It is perfectly obvious, since the apparent motions of the heavens are so regular, that if that be so, she must move with wonderful constancy and regularity: she does not first move in one direction and at one inclination, and then at another; that would be very serious.
>
> If she rotates she must rotate round some imaginary line called an axis. This introduces an important consideration, because, whether the earth itself rotates on an axis, or the heavens move round the earth—and in the latter case the heavens must also move round an axis—in either case the motion must be an equable one, so that if the matter is thus limited to a constant axial rotation, or a constant revolution as it would be called in the case of the stars, several things will happen.

And so the explanation maunders on.

Here is another exquisite bit of "explanation":—

> If we assume the earth to rotate, we must carefully consider the varying conditions which are brought about by the different positions of an inhabitant of the earth under those circumstances. For instance, take the case of a man at the equator: he looks at things from an equatorial point of view, and in the rotation of the earth he plunges straight up and straight down.

Having in the fashion thus illustrated "explained" the apparent daily motion of the stars, Mr. Lockyer proceeds to explain their apparent diurnal motion. Here is the "explanation":—

> The same difficulty that was met with before is again encountered here—Is this movement of the sun among the stars a real or an apparent one? It is a question, however, which has been long since answered; and it can be very definitely stated, not only that the earth rotates on its axis in a period of twenty-four sidereal hours, but that it moves or revolves round the sun in a period which we call a year, and that it is this real movement which causes the apparent one of the sun among the stars. Let the reader take a top and spin it. Perhaps the top has a movement of progression as well as a movement of rotation, and it is in that way quite easy to see that the earth may rotate on its axis and revolve about the sun at one and the same time. And with a top of special construction its axis of rotation might be inclined so that its plane of rotation ceased to coincide with the plane of its motion of progression; still the two movements would go on, and in whatever position the top might be placed, its axis might be made to remain practically parallel to itself during its movements. We may now, then [oh, this *must* be a joke!], make the following statements:—*The earth revolves round the sun, and throughout the revolution the axis of rotation remains practically parallel to itself.* With regard to the latter part of this statement, it may be added that if this were not so—if the axis of the earth were subject to perpetual change of direction—the declinations of the stars would also be subject to constant change.

Finally, here is a passage from Mr. Lockyer's explanation of the aberration of the fixed stars:—

> In the case of the majority of the stars what we get is an ellipse, and in an ellipse we have certain differences which have to be taken into account, the last difference of all being that an infinitely elongated ellipse is a straight line, and it is found that from one particular point of the heavens where, in consequence of this aberrational motion, the orbits of the stars round their mean places are almost circular, we at last get to a point where the motion is simply an oscillation of the star backwards and forwards to and from its mean place: we are dealing, in fact, with that projection of the ellipse which takes the form of a straight line. When we deal with an ellipse we no longer talk of the radius, but of the semi-axis major, which is half the greatest length. The angle of aberration of which I have spoken only amounts to 20″·492, but though small, it is quite enough to prove that the earth does revolve, and that consequently the sun is the centre of the system to which the earth belongs, while it further tells us that the movement of the earth is slow compared with that of light.

Luckily no reader is likely to suppose he is really getting any explanations in such passages as these.

Gossip.

By Richard A. Proctor.

Messrs. Maunder & Knobel desire to have it explained that the unnamed "Professor" referred to in "Gossip" for April did not appeal to them, as I had surmised and naturally (almost necessarily) believed—see p. 138—to announce (in a magazine which I was certain not to see and almost certain not to hear of) that I had not actively assisted his election to the Foreign Associateship of the Royal Astronomical Society. They did this thing of their own accord, not at the "Professor's" instigation at all. I willingly accept and publish their contradiction of my most natural mistake. They agree in speaking of this mistake as injurious; but without explaining how or why it was injurious, or whom it could possibly injure. It could not injure their *protégé*, he being past that; and though certainly it ought not to be pleasing to them to be supposed to be in correspondence with him, they had published more than that about themselves in the very letters on which I commented.

* * *

The case was simply this—Messrs. Knobel & Maunder chose on partial information, amazingly misunderstood, to interfere in a matter in which they had no sort of concern, undertaking to contradict what I had not said and what a moment's reflection should assure any honest mind that I could not have intended to say. (Mr. Maunder admits in a letter from which, though marked "private," I am entitled in self-defence so far to quote, that when the complete correspondence, of which he and Mr. Knobel had seen only part, was before him, the impression he had formed of my meaning was "*proved* not to be the one I intended to convey"; and I maintain that even with the one letter he had seen my meaning should have been as clear as day to him and to Mr. Knobel.) For reasons best known to themselves they selected as a suitable place for the attempted injury to me a magazine which I never see, as they can

scarcely but know. Yet rather than attribute to them either (1) deliberate unfairness, or (2) wilful misrepresentation, or (3) gross blundering, or (4) inability to appreciate the rules which customarily guide men of honour, I generously took it for granted that they had been misled by a person known to have striven by untruths to injure another, and therefore unquestionably capable of untruth for his own benefit. It appears that I was altogether mistaken, so that one or other of the four explanations which alone remained available must be accepted. I am sorry for this. But my sorrow is by no means apologetic. It signifies rather my strong feeling that an apology is due to myself.

* * *

On the other hand, I am glad to find that I was not right in supposing that Mr. Fraser—(see Knowledge for June, pp. 186, 187)—had any thought of attributing unfairness, either to myself or to the author of the criticism to which he objected. I still think that Mr. Fraser was wrong in writing as he did, but I withdraw all that in my remarks about him went beyond that.

* * *

With regard to his heat theory of gravity, Mr. Fraser writes to me admitting that if the instantaneous action of gravity is proved the heat theory fails. But he asks whether the instantaneous action is proved? May not "the obstruction from meteoric gas and other matter in interplanetary space neutralise the acceleration which would be caused by the non-instantaneity of gravity"? I have never had much liking for the "may not" style of argument; but in presence of the absolute perfection with which all the planetary movements are explained, when gravity is assumed to be practically instantaneous, the suggestion that the various measurable departures from perfect agreement necessarily arising if gravity travels no faster than heat are all exactly corrected by the resistance of meteoric gas is too wild to be admitted for a moment. It would scarcely be less reasonable to suggest that gravity has no existence at all, but that the several planets are all kept in their proper paths by the resistances of meteoric gas and other matter in interplanetary space. The theory of gravity is regarded as established because it accounts in quantity and quality for all the movements of all the heavenly bodies. If all we could say of it was that possibly, were all the conditions known, gravity might be found to explain the planetary movements, the astronomy of to-day would be where astronomy was in the days before Copernicus.

* * *

Mr. Malet, the author of "Sunlight," has not written to me complaining about the criticism of *his* paradox—or, rather, his letters, though addressed to the Editor, were not forwarded to me (the said Editor) in my distant home, but to the gentleman who criticised Mr. Malet's speculations about light. From what I learn about Mr. Malet's letters, his light is wanting in sweetness.

Reviews.

In Pursuit of a Shadow. By A Lady Astronomer. (London: Trübner & Co.)—Among the English astronomers who undertook a journey to Russia to observe the total solar eclipse of August 19, 1887, appears to have been the authoress of the very pleasant, chatty, and agreeable little book before us. In company with another lady, she faced an experience of more or less toilsome travel of between two and three thousand miles into the heart of Russia, unhappily only to meet with disappointment, clouds practically hiding the whole phenomenon from the view of those who had come so far and toiled so bravely to view it. But if our "Lady Astronomer" was disappointed, her readers assuredly will not be, for it is long since we have seen in print so readable and unaffected an account of a journey through a comparatively strange country as she has given us. She tells of her voyage from Hull to Christiania, thence to Stockholm, on to St. Petersburg, and through Moscow to Pogost, where she was apparently the guest of Professor Bredichin; and whence, had the weather been propitious, the eclipse was to have been observed. After the disappointment of herself and her lady companion, she went on to see something of the world-famed fair of Nijni-Novgorod, and returned home *viâ* Smolensk, Warsaw, and Berlin. All this is told in the most delightfully chatty manner, without a trace of guide-book padding, irrelevant quotation, or any of the other devices by which modern works of travel are swollen into bulky books. We can cordially recommend this tiny volume.

Faustrestra: a Drama, with Other Poems and Essays. By Verestra, B.Sc. (London). (Clapham: T. Fox. 1887.) Whether the author of this ridiculous trash is simply irresponsible for his actions, or whether he is indulging in some form of "chaff" too esoteric for our comprehension, we cannot take upon ourselves to determine. An extract, taken absolutely at random from the so-called "Drama," may perhaps enable some more penetrating reader to divine which (if either) of these two hypotheses is correct:—

UNDINE.
Not to mention clear'y all the
Circumstances.

LADY JOAN.
I've lived all my
Life long in the sacred fame of
All the Virtues so to speak till. . . .

UNDINE.
Many were the escapades which
Took place in the misty shadows
Of its aisles. I've heard about them.

LADY JOAN.
Since you are so very learned
On the subject may I ask from
Whom you heard about these mighty
Escapades.

MADAM ANYBODY.
We knew about them.
Walls have ears, you know,—You humbugged
Many—not us, though.

LADY JOAN.
It seems you
Know more of my history than
I myself do, so you'd better
Tell it, or proceed to tell your
Own ones.

The author seems to lapse into something approaching temporary sanity in a concluding Essay on the Senses.

Granites, and our Granite Industries. By Geo. F. Harris, F.G.S. (London: Crosby Lockwood & Son. 1888.)—Within the space occupied by 134 pages Mr. Harris has contrived to convey a very large amount of information on the subject to which his volume is devoted. The geologist will here find an exposition of the latest theories of the origin of granite, and the petrographer full details of its lithological structure; while all interested in it, in its commercial and economical aspect, may learn whence it is obtained, and how quarried and worked. A description of the method of turning it in the lathe, and of the other mechanical processes by whose aid it is wrought, form the subject of the eleventh chapter. Fifteen woodcuts illustrate the text, and there is a very full index.

History of South Africa (1486–1691). By George McCall Theal. (London: Swan Sonnenschein & Co. 1888.)—Every one who wishes to understand the existing condition of our South African colonies will derive valuable assistance from Mr. Theal's exhaustive history, of which the first instalment lies before us. Beginning with the original discovery of the Cape of Good Hope by Bartholomew Dias in 1486, he brings his story down to the time of the rule of Commander (eventually Governor) Van der Stel, during whose tenure of office so considerable an emigration of the French Huguenots occurred: the narrative terminating with the year 1691. What the rule of the Dutch East India Company in South Africa was may be well realised from the vivid description given by our author of the occurrences during the period covered by the present volume. It obviously embodies the results of a very large amount of research indeed, and will well repay perusal.

Facts about Ireland: a Curve-history of Recent Years. By Alex. B. McDowall, M.A. (London: Edw. Stanford. 1888.)—In this little book Mr. McDowall has applied the system of plotting curves, now so generally employed for showing meteorological data graphically, to the exhibition of a variety of Irish statistics. As a rule, the years form the abscissæ and the quantities dealt with the ordinates of his curves, and in this fashion he shows the fluctuations in agriculture, education, crime, intemperance, emigration, bank deposits, and the like. The idea of thus popularising a mass of numerical data is not a bad one.

Disease: its Prevention and Cure by Simple Natural Means, &c. By Chas. G. Godfrey. (London: H. Grevel & Co. 1888.)—*The Increase of Cancer in England.* By John Francis Churchill, M.D. (London: David Stott.)—If Dr. Churchill's statistics are trustworthy, a most alarming increase of cancer is in progress in this country, an increase which he traces to the reckless use in modern therapeutics of oxidisable phosphorous compounds, whose employment he deprecates in the strongest manner. His remedy must be sought in his book itself. Mr. Godfrey proposes to cure cancer and a variety of other diseases by the use of dry food, by common salt, and by a very large diminution of the amount of liquid consumed. It is piteous to read of the death of his only daughter after he had, as he alleges, cured her of blindness (!) by his peculiar method of treatment.

A Fight with Distances. By J. J. Aubertin. (Kegan Paul, Trench, & Co.)—The "distances" with which our restless author fought within the narrow space of ten months cover well-nigh the North American Continent and the chief West Indian islands. He brings himself perilously near Matthew Arnold's crowd of hurrying men "who see all sights from pole to pole, yet never once possess their soul before they die." The book has the defects and merits of Mr. Aubertin's previous records of like scampers in Mexico and South Africa, but as he always adds to our store of information, and that in good-tempered, unaffected talk, we forgive the intrusion of peddling details, and commend the book to all lovers of travel-records, especially to any who may be contemplating a similar trip.

Lucian's Dialogues. Translated by Howard Williams. (Bell & Sons.)—Instead of adding to the over-translated among the ancients, Mr. Williams has laid us under obligation by this admirable and much needed translation of the more important and best-known works of the great "Pantagruelist of Samosata." The simplicity, raciness, wit and common sense, which are the features of the Dialogues of the Gods and of the Dead, have not vanished in the process of transfer from Greek to English, and we hope that the present work will meet with success that shall encourage Mr. Williams to give us another volume. The translations are prefaced by an admirably full and clear introduction, and enriched with abundant notes.

Memory, What it is, and How to improve it. By David Kay, F.R.G.S. (London: Kegan Paul, Trench, & Co. 1888.)—Mr. Kay, having produced a work of high interest, which affords evidence of extensive reading and research, and abounds in a wealth of illustration, has made it almost unreadable by the simple expedient of crowding almost every page with footnotes! Anything more wearisome and distracting we scarcely ever remember to have met with, and the reader's irritation becomes greater as he often finds the *ipsissima verba* of the text repeated in smaller type below. Of course it is possible to skip these annotations, and any one who will resolutely do so will find Mr. Kay's volume interesting and instructive in a high degree; but the initial temptation to refer to them is as great as is the annoyance incident on yielding to it. When the work before us reaches its second edition, we would venture to suggest that such evidence of its author's erudition as quotations may be held to afford should be relegated to an appendix, and not suffered to confuse the reader as they do in their present position. With this emendation, we could cordially recommend a book from which much is to be learned of enduring value.

Game, Shore, and Water Birds of India. By Colonel A. Le Mesurier, R.E. (London: W. Thacker & Co. 1888.)—Compact in form, excellent in method and arrangement, and—as far as we have been able to test it—rigidly accurate in details, Colonel Le Mesurier's book should become the vade-mecum of every sportsman and naturalist whom duty or pleasure may compel to visit India. The numerous and excellent illustrations (of which no less than 121 appear in 148 pages) render the identification of genera a matter of great simplicity.

Restful Work for Youthful Hands. By S. F. A. Caulfeild. (London: Griffith, Farran, Okeden, & Welsh. 1888.)—We grieve to have to utter anything in disparagement of a little volume written with the laudable object of showing how children in the upper and middle ranks of life may profitably employ their spare time in benefiting others. It is, however, rather with Mrs. Caulfeild's manner than with her matter that we have any quarrel. The fact is that texts and goody-goodiness are somewhat too obtrusively introduced, and there can be no doubt that the work would gain by their excision. Our own experience is that a child like "Rose" who is always being preached and quoted at learns at last to loathe the source of the quotations rained upon her devoted head, and, as soon as she is emancipated from the amiable and zealous fanatics who make her a target for discharging the contents of the Scriptures at, rushes into the very extremity of worldliness. A judicious parent might, however, teach her daughter many valuable lessons from Mrs. Caulfeild's small book if she would merely suppress such parts of it as labour "to improve the occasion."

Notes on Shakspere's "King Henry V." By T. Duff-Barnett. (Bell & Sons.)—Just the thing for the teacher. Immersed in teaching, and without the time needed to digest and arrange and tabulate the information he has been giving to his class, here he has to his hand the points which most of all require careful attention, and concentrated attention if his boys are to do well at their examinations. Mr. Barnett is a practical teacher, and has shown as much discretion in what he has omitted as in what he has inserted. There is nothing in his book that a student of the play

ought to fail to notice; and he will look in vain for the niggling "readings" and the often ill-rewarded "see page so-and-so" which encumber the notes of editions even so good as those of the Clarendon Press. Mr. Barnett's book will be invaluable for the local and army examinations.

Primer of German Literature. By Isabel T. Lublin, F.R.Hist.S. (London: Swan Sonnenschein, Lowrey, & Co. 1888.)—Miss Lublin's work is confined to the belles-lettres, and wholly excludes the enormous mass of scientific literature—mental, moral, and physical—so eminently characteristic of the German race. Beginning with the earliest records, our authoress gives, in the first portion of her book, a *précis* of every work whose fame has descended to the present day. The latter half of the work consists of a series of succinct biographies of all those who have enriched German literature, with lists of the works by which they have been chiefly distinguished. The very comprehensive character of the volume may be gathered from the fact that it opens with Ulphilas (*circa* A.D. 340), and concludes with Von Ranke, who died in 1886.

The Vision of a Passion, and other Poems. By Thomas Folliott. (London: Wyman & Sons. 1887.)—The poem from which Mr. Folliott's book takes its title is in blank verse, and is not without a certain amount of grace in places, albeit falling short of that excellence which can alone render such numbers attractive. Of his versified pieces, "Alice" has a needlessly dismal ending. We would invite Mr. Folliott's attention to the fact that "streaming far" does *not* rhyme with "gleaming are," as he appears to imagine, on p. 56.

Prosperity or Pauperism? Physical, Industrial, and Technical Training. Edited by the Earl of Meath. (London: Longmans, Green, & Co. 1888.)—Having once admitted, and acted on, the Socialistic principle that it is the duty of the State to "educate our masters," the nature and character of such education become a matter of vital national importance. The net result of the existing system has been to unfit the children of the labouring classes for their own station, without rendering them fit for any other—to dissatisfy them with manual labour, and to tempt them to crowd the ranks of clerks and pupil teachers, under the preposterous notion that handicraft is vulgar and clerical work "genteel." To show the enormous advantage which must accrue at once to the individual, and to the nation at large, Lord Meath has collected a series of essays, reports, and speeches by men of the most diverse intellectual calibre—from Lord Hartington down to Mr. Mundella. The thoughtful reader will readily separate the wheat from the chaff in this heterogeneous compilation, and will probably come to the conclusion that for lads to learn to make a dove-tail joint, or in agricultural districts to be taught something of the nature of soils and manures, and for girls to learn to cook a plain joint and scrub a floor, would be almost infinitely better than for them to be crammed with the French and algebra which now so preposterously form a part of our Board School curriculum.

Raygarth's Gladys and other Poems. By James Saunders. (London: Thomas Laurie. 1888.)—Mr. Saunders is scarcely at his best in the blank verse of the poem which gives its title to this collection of his pieces. Now and again he wanders into true poetry. His small volume is at least up to the average of any of those of fugitive verse which have recently been issued.

The Way to Fortune. (London: T. Fisher Unwin. 1888.)—In a series of aphorisms and anecdotes, strung together in fifty short essays, the anonymous author or compiler of this little book really does contrive to give some very sound and useful advice to the youthful aspirant to fame and fortune. His work may be regarded as "Poor Richard," amplified and extended, and would form a far from useless present to a lad starting in life.

Children's Services, with Hymns and Songs. Edited by the Rev. A. W. Oxford, M.A. (London: T. Fisher Unwin. 1888.)—These short, bright, simple little services should prove a blessing to unnumbered hundreds of miserable children who are compelled, Sunday after Sunday, to sit wearily through the battology of the three rolled into one with which the Church of England hebdomadally afflicts its attendants.

THE FACE OF THE SKY FOR AUGUST.

By F.R.A.S.

THE spotless sun is absolutely devoid of interest as a telescopic object. On the evening of August 7 there will be a very small eclipse of the sun, its magnitude even at the time of greatest phase being only 0·013 of the sun's diameter. It begins at Greenwich at 6h. 48·8m. P.M., the greatest phase happens at 6h. 57·7m. P.M., and by 7h. 6·5m. P.M. the moon has entirely cleared the sun's disc. The first contact happens at 32° towards the West from the apparent top of the sun, and the last contact 13° towards the West. The sun sets at 7h. 36m. Map viii. of "The Stars in their Seasons" shows the aspect of the August night sky. Minima of the curious variable star Algol ("The Stars in their Seasons," map xii.) will occur on August 2, at 11h. 13m. P.M., on the 5th at 8h. 2m. P.M., on the 22nd 55m. after midnight, and on the 25th at 9h. 41m. P.M.; as also on other occasions less favourable for the amateur observer. Mercury is a morning star during the first three weeks, but comes into superior conjunction with the sun at 1h A.M. on the 24th. At the beginning of the month he may be detected in the E.N.E. before sunrise. Venus is an evening star, but is an insignificant object, and hardly worth looking for. Besides, she is close to the horizon at sunset. She will be some two diameters of the sun north of Regulus ("The Stars in their Seasons," map iv.) on the 11th. Mars is now receding from the earth, and looks like a mere big red star in the telescope. He must be looked for the moment it is dusk. Jupiter is worse placed still; he may be picked up as soon as he is visible in the twilight to the west of β Scorpii ("The Stars in their Seasons," map vii.). The phenomena of his satellites, which, the weather being clear, will be certainly visible, are: The egress of the shadow of satellite i. at 9h. 15m. P.M. on the 3rd; the ingress of the shadow of the same satellite at 8h. 58m. P.M. on the 10th; the reappearance from eclipse of satellite i. itself at 8h. 23m. 13s. P.M. on the 11th; the ingress of the shadow of satellite ii. at 8h. 10m. P.M. on the 18th; followed by that of the shadow of satellite iii. at 8h. 50m. P.M. Then on the 25th the transit of satellite ii. will begin at 8h. 6m. P.M.; on the 26th the egress of satellite i. will happen at 8h. 14m. P.M., and, finally, on the 27th satellite ii. will reappear from eclipse at 7h. 58m. 27s. P.M. Saturn, Uranus, and Neptune are all invisible. Watch should be kept on the 9th, 10th, and 11th for the shower of shooting stars, through which the earth annually passes, and which, anciently called "St. Lawrence's tears," are now known to astronomers as the Perseids, from the fact that they appear to start from the constellation Perseus ("The Stars in their Seasons," map xii.). The moon will be new at 6h. 21·0m. in the evening on August 7, enter her first quarter at 4h. 44·1m. P.M. on the 14th, be full at 4h. 20·3m. P.M. on the 21st, and enter her last quarter at 2h. 18·3m. in the afternoon on the 29th. Two stars only will be occulted by the moon before midnight during the present month. The first is ψ^3 Aquarii of the 5th magnitude, which will disappear at 9h. 46m. P.M. on the 22nd at the moon's bright limb, at an angle of 29° from her vertex; reappearing at her dark limb at 10h. 30m. P.M. at an angle from her vertex of 320°. The second occultation occurs on the night of the 26th, when ξ^2 Ceti, a 4th magnitude star, will disappear at the bright limb of the moon at 11h. 20m. at an angle from her vertex of 98°. It will reappear at her dark limb 22 minutes after midnight at a vertical angle of 238°. When our notes open the moon is in Taurus ("The Seasons Pictured," plate xxiii.). As she traverses this constellation she arrives at 10h. P.M. on the 3rd at the extreme north-western boundary of Orion. It only takes her some 9½ hours to cross this, and at 7h. 30m. the next morning she emerges in Gemini ("The Seasons Pictured,"

plate xxiv.). Her journey through Gemini is completed by 5h. 30m. A.M. on the 6th, at which hour she enters Cancer. She quits Cancer for Leo at 7h. P.M. on the 7th, and Leo in turn for Virgo at 9h. A.M. on the 10th ("The Seasons Pictured," plate xxv.). She remains in Virgo until 1h. 30m. P.M. on the 13th, when she crosses the boundary into Libra ("The Seasons Pictured," plate xxvi.). In the course of her journey through Libra she arrives at 6h. A.M. on the 15th at the western edge of the narrow northern spike of Scorpio, when by 3 o'clock the same afternoon she has crossed this it is to come out in Ophiuchus, a constellation which she leaves for Sagittarius at 4h. A.M. on the 17th. By 10h. A.M. on the 19th she has traversed Sagittarius and entered Capricornus ("The Seasons Pictured," plate xxi.). She leaves Capricornus for Aquarius at 8h. 30m. A.M. on the 21st. She is travelling over Aquarius until 11h. A.M. on the 23rd, and she enters Pisces ("The Seasons Pictured," plate xxii.). Journeying across Pisces, she at 4h. A.M. on the 24th plunges into a portion of Cetus, and continues in that constellation until 1h. 30m. P.M. on the 25th, when she emerges in Pisces again, only, however, to re-enter Cetus 10h. later. When she quits Cetus for the second time at 5h. A.M. on the 27th she comes out in Aries ("The Seasons Pictured," plate xxiii.). She remains in Aries until 5h. 30m. A.M. on the 28th, and then passes into Taurus, travelling through which, as at the beginning of the month, she reaches the northern prolongation of Orion at 6h. A.M. on the 31st. At 5 o'clock that afternoon her journey over this is complete, and she quits Orion for Gemini. There we leave her.

Our Whist Column.

By "FIVE OF CLUBS."

MATHEWS ON WHIST—*concluded.*

PLAYING TO THE SCORE.

YOU should not give up the certainty of the odd trick for an even chance of making two by tricks, nor that of making or saving a point for an even chance of making an extra trick. And conversely you should risk a finesse giving you an even chance of preventing your adversaries from getting the odd trick or from making or saving a point. [In Mathews reference is made to the points at long whist, and the wording is obscure: the strategic principle is the same both for short whist and long whist.]

When at three, with two honours, note the adversaries' score and consider whether there is a probability that they may win the game by tricks, or make a point, even though your partner should hold a third honour. If there is, you should conceal your strength in honours as long as possible, as a knowledge of it would give the adversaries a decided advantage against you in playing for tricks.

To explain what is meant by playing to the score or to points, consider the following case:—

A has the two lowest trumps, and two forcing cards with the lead. The two best trumps are known to be with the adversaries, but it is uncertain whether they are divided or both in the same hand. Nine tricks have been turned. *Query*: What should A play? *Answer*: This can only be decided by considering the score, and inquiring whether it justifies hazarding two tricks for one or not. It should be obvious that before the score is much advanced it would be quite wrong for A to play a trump, because by so doing he manifestly ventures two tricks for one: he should therefore secure two tricks by playing a forcing card. But suppose A-B are at the score of two, and that they have won six tricks, Y-Z not having reached the score of four: then as obviously A should play the trump, because if the other trumps are divided A wins three tricks and the game, and if they are not divided A-B remain at the score of two: the even chance of winning the game is better than the certainty of reaching the score of four. If the adversaries are at the score of four, A should of course not lead a trump, for he is certain to save the game if he leads a forcing card, and there is an even chance of his losing it if he leads a trump.

The following critical stroke decided one of the most material rubbers [as to the amount of money depending on it] ever played, and is recommended to the attentive study even of proficients:—

The score was nine-all [corresponding to four-all at short whist]. A had won six tricks, and remained with knave and a small trump, and two diamonds, with the lead. Y, his left-hand adversary, held the queen and ten of trumps and two clubs. B, A's partner, had two small trumps and two diamonds. Z, the last player, held the ace of trumps and a small one, a club, and a heart. A led a diamond, which was passed by Y, and was to be won by Z. *Query*: How is Z to play to make it possible to win the odd trick? *Answer*: Z saw it was impossible to win the odd trick unless his partner held either the two best trumps or the first and third, with a successful finesse [that is, the second-best with A]. He therefore trumped with the Ace, and led the small one, and Y finessing the Ten, Y-Z won the game. [By taking the trick with the Ace, Z made his partner's trumps the best and third best, which before the Ace was played were the second and fourth best. Clearly had he retained the Ace only one round of trumps could have been taken out, and one trick must go to the enemy, even though Y held the two best trumps after the Ace. It will be noticed, of course, that Z's play would have been quite wrong had the score been other than it was. For by ruffing with the small trump, Z would make sure of three tricks out of the four last, whereas by playing the Ace he left it more than an even chance that Y-Z would make but two tricks. Since, however, three tricks would be worth no more to Y-Z than two, when all four were wanted to save the game, he won the game for himself and partner by his correct strategy in playing to the score.]

SOME POINTS OF STRATEGY.

The difficulty of Whist does not consist in playing good cards to advantage, for Aces and Kings will make tricks, and no skill can make a Ten win a Knave. But there are hands which frequently occur when skilful players win where bunglers lose points, and, except where the cards run very high, it is on the playing of such hands that success depends.

For example, suppose a player holds Ace or King and three other trumps, a tierce-major with others of a plain suit, and a probable trick [that is, a probable re-entering card] in a third suit, the player's plan here should be to remain either with the last trump, or with the last but one, with the lead. To accomplish this he must not win the second trick with his commanding card, but reserve that card for the third. Nothing, then, but five trumps in one hand can probably prevent his establishing his long suit. For where he finds but four trumps against him in one hand, and the fourth or last left of those adverse trumps is against him, he forces it out with his long suit, and then the thirteenth trump brings in his suit again, which without the lead after the third round of trumps would be impossible.

[The "probable trick in a third suit" is required to give the trump leader a fair chance of leading a third round of trumps, should his partner be unable to lead trumps again. Mathews gives as illustrative cases, to make his "maxim"—as he calls it—more clearly understood, a series beginning with the same case precisely which has just been dealt with. The others are as follows]:—

A with a strong suit headed by the tierce-major, a probable trick in a third suit, holds Ace, King, and two small trumps. If the adversaries lead trumps he should not win the first trick, even if last player. By passing, he remains after the second round with the best card for the third, and establishes his suit, even though the best trump remains against him, unless there were five trumps in one hand originally.

With a similar hand and Ace, Queen, and two small trumps, do not win the Knave led on your left hand, but let trumps be led again. You then take out the third round, and remain as in the case last considered.

[The following special case is worth noticing]:—

A remains with the best trump (say the Ten) and a small one, with some losing cards, B, his partner, having to A's knowledge the second best (say the Nine) with some winning cards, the adversaries having some winning cards of the other two suits. A is forced. *Query*: How should he play? *Answer*: A should ruff with his best, and lead out his small trump; he thus puts the lead in his partner's hand, enabling him to make his winning cards, while those of the adversaries are rendered useless. This mode of play would sometimes be right, even when it was not certain whether the second-best trump was in partner's or an adversary's hand; but the fine player alone can determine the correct play under such conditions.

Judgment is often required in taking the penalties of a revoke. Before the score is advanced, if the party revoking has won nine tricks, the least consideration will show that the adversaries should take three of them: for if they add to their own score they still leave the odd trick to the enemy. But if the revoking party is at the score of three, it is better for the adversary to score three points, as the odd trick leaves the former at four, which is in every respect a worse point than three. [In the original the reference is to long whist, in which perhaps the privilege of the "call" made the score of eight preferable to the score of nine; but in short whist sound players prefer the score of four, for the reason aptly indicated by Mr. Bentinck, that the possession of three honours does not *absolutely* prevent the winning of the odd trick.] On other occasions it is only necessary to calculate how the different

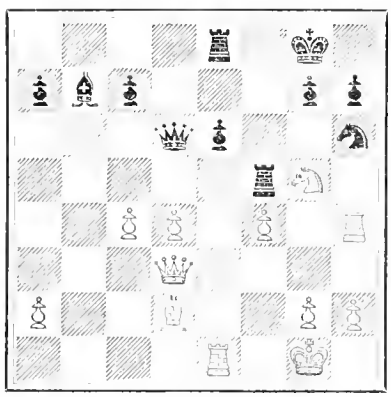
scores will remain after each mode of taking the penalty, and to select that which gives the best result, never losing sight of the points of the game, noticing that is, that you are to score one or three yourself, or prevent your adversary from so doing.

Our Chess Column.

By "Mephisto."

A VERY interesting position in a game, wherein Black had given the odds of Pawn and two moves to White:—

GUNSBERG.
Black.



White.
E. SELLON.

White played
P to Kt4
An excellent move, which ought to win, as Black cannot at present move his Rook.
Black replied

	Q to B3
P to Q5	Q to Kt3 (ch)
B to K3	Q to R4
B to Q2	

Instead of this move, White might have played R to K2 without any fear of complications, leaving Black's position as before.

	Q to Kt3 (ch)
K to Bsq	

Played in the hope of preventing any further dilatory moves by the Black Queen.

	R × Kt

This move came like a bright gleam of hope in a lost position. If White replies P × R, then Black plays R to Bsq (ch), following this up by Q to B7 (ch); and then, if White plays K to Rsq by P × P, &c., with a fair attack—

	B to K3

A very plausible move, and much superior to P × R.

	R × QP

Another timely saving move.

P × R	B to R3

The third move of the entire combination, winning another piece.

B × Q	B × Q (ch)
K to B2	RP × B

Black ultimately won.

An Algaier Gambit, played a few days ago between two strong players, produced the following very pretty game:—

White. A.	Black. B.
1. P to K4	1. P to K4
2. P to KB4	2. P × P
3. Kt to KB3	3. P to KKt4
4. P to KR4	4. P to Kt5
5. Kt to Kt5	5. P to KR3
6. Kt × P	6. K × Kt
7. P to Q4	7. P to Q4
8. B × P	8. Kt to B3
9. B to K5	9. B to Kt2
10. Kt to B3	10. P × P
11. B to B4 (ch)	11. K to Kt3
12. Q to K2	12. P to KR4

This is seldom a good move in this opening. R to Bsq is better.

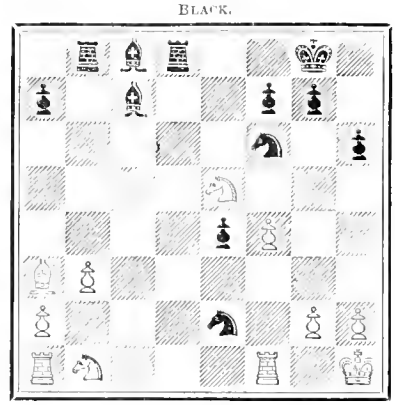
13. Kt × P	13. Kt × Kt

This is a very natural move, but White surprised his opponent very much by announcing mate in six moves. This was given as follows:—

14. Q × Kt (ch)	14. B to B4
15. Q × B (ch)!	15. K × B
16. Castles (ch)	16. K to Kt3
17. B to Q3 (ch)	17. K to R3
18. B to B4 (ch), and mates next move.	

A pretty end-game played by Herr D van Foreest, of Amsterdam:—

D. VAN FOREEST.
Black.



White.
AMATEUR.

It was White's turn to move, and he played—

1. Kt to B6	1. B to Kt2
2. Kt × QR	2. Kt to Kt5
3. B to B5	

Black threatened mate by Kt to B7 (ch), followed by R to Q8 (ch)

	3. P to K6.

Still threatening the same mate

4. P to KR3.	

Now Black mated in four moves by

	4. R to Q8
5. Kt to B3	5. Kt to B7 (ch)
6. K to R2	6. B × P (ch)
7. P to Kt3	7. B × P mate.

We have received from Mr. Clement L. Wragge, F.R.G.S., of Brisbane, the Government meteorologist of Queensland, two of his elaborate daily charts of the weather prevailing over the entire Australian Continent and New Zealand. Scientific meteorologists and geographers may be glad to know that the Postmaster-General for Queensland has fixed the annual subscription for these most instructive maps at 2*l.* 2*s.* (payable in advance) post free to any part of the British Empire.

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GOD'S WORK AND WORD.

If for the FALL of man science comes to substitute the RISE of man, sir, it means the utter disintegration of all the spiritual pessimisms which have been like a spasm in the heart and a cramp in the intellect of man for so many centuries. And yet, who dares to say that it is not a perfectly legitimate and proper question to be discussed, without the slightest regard to the fears or the threats of Pope or Prelate.—WENDELL HOLMES.

IT is surprising that, after the experience men have had of its dangers, the Bible argument in regard to matters scientific should be used by any even pretending, still more by those who actually desire, to be faithful and loyal servants of true religion. Time and again this unwise argument has been employed to oppose scientific discoveries, and time and again its futility has been shown, and the mischief of employing it demonstrated. Strange that some men should be so quick to perceive the manifest truth that the word of God cannot be untrue, so blind to what should be the equally obvious fact that that which is untrue *cannot* be the word of God. Ready to denounce, on the one hand, as blasphemy aught which seems to question the truth of what they regard as the word of God, they never seem to suspect the awful blasphemy of which they themselves are unwittingly guilty in maintaining that to be the word of God which has been shown to be, were it but in the minutest detail, untrue.

Let it be remarked that, with what seems to many the bane, science has ever brought the antidote. If one department of science in its quiet progress has shown that many statements once accepted without question cannot possibly be true, another department of research has with equally calm and patient inquiry shown that those statements never have merited the reverential respect which had been accorded to them in consequence of singular misapprehensions as to their origin. If science has shown—to speak plainly—that sayings regarded by some as the very word of God have been wanting in scientific accuracy, science has been careful to remove all trace of irreverence from such declarations by showing not less unmistakably that there never has been any real justification for regarding those sayings as other than the words of men—thoughtful and earnest men, but with no power of discovering those truths which have been revealed under later scientific researches.

To take one case alone, though I could fill column after column with illustrative instances, it has been shown that in one particular book of a certain heterogeneous collection of ancient books and poems, there are mistakes in regard to scientific matters, misapprehensions as to the meaning of passages in old Jewish poems, and details quite irreconcilable with history as recorded in the pages of Josephus, Philo-Judæus, and other trustworthy writers of the history of their own times. But at the same time that this has been done, it has been shown that that book was most certainly not written by the man whose name has been connected with it, but was compiled long after he was dead. If the writer of that book speaks of the earth as a modern paradoxist might, telling us of an exceeding high mountain from which all the kingdoms of the earth and their glory could be seen, and if the science of later years has been responsible for showing this to be impossible, later science has shown also that the Alexandrian Greek who, somewhere about the year 110, produced the work in which this error (very natural in his time) appears, cannot reasonably be supposed to have been inspired. So with the strange misapprehensions (also very natural, however, nearly 1800 years ago) respecting epileptic, cataleptic, and maniacal seizures, and the elaborate ingenuity with which the Alexandrian Greek displays his very natural ignorance about Hebrew poetry—as in imagining that "the ass and the colt the foal of an ass" were two distinct animals, in misinterpreting (overlooking or forgetting the context) Isaiah's prophecy about Maher-shalal-hash-baz—and so forth. The science of Biblical research has explained clearly enough how natural all this was. And if, whereas science recognises the human race as descended from a race already multitudinous, two genealogies in the collection of Jewish and Alexandrian books agree, though otherwise contradicting each other, in assuming that man was descended from a single pair (the first genealogy, though going back only to the supposed single ancestor of the Jewish race—another impossibility by the way—really assumes the single pair of Paradise), science is at no pains to explain the very natural mistake. Doubtless nothing but a succession of miracles could save the descendants of a single pair from destruction, to say nothing of the renewal of the miracles called for by the destruction of all save four pairs by the flood (each of the three younger pairs starting, miraculously, a branch of the human family), and of the multitudinous repetition of the miracle in the case of all the paired animals of the ark, as also in the supposed origin of distinct human races from single pairs. Science has proved, again and again, that no races descended from a single pair can thrive, if kept "pure" in the technical sense (though so far as certain laws which seem innate in man are concerned this would hardly be the word we should apply to the imagined beginnings of human races). Such races cannot escape degeneration and early destruction. But science, to which the study of history and Biblical research alike belong, has been able to show the conditions under which those ancient writings were produced, and how unlikely it was that their writers should possess knowledge in advance of the knowledge of their day. [In passing I may remark that the first gospel was specially the gospel of the Ebionites, and the only gospel they accepted; yet even they (who probably knew more of their own gospel and valued it more highly than any others) regarded the genealogical record in it as interpolated.]

In like manner, Biblical research has shown clearly on what an essentially human basis—narrow too, being characteristically Jewish—the teaching has been established that the record in the earlier chapters of Genesis (a Jewish compilation from Babylonian documents) is the very word of the Infinite Power from whom all things throughout Infinite Space and during Eternity of Time proceed. For my own part, let me remark in passing, though I am ready to admit the honesty of those who proclaim their belief in this essentially blasphemous idea, I must confess I cannot readily shake off the pain with which I contemplate a doctrine so stupendously repugnant to all sense of reverence for the Power Which—Infinite as It must be in Wisdom, Omnipresent and Everlasting as well as Almighty—must also be Absolute Truth. It is saddening that in our days of en-

lightenment men should associate with this Power these imagined revelations, whose only support has been the overweening race-conceit of the Jews, and, later, the decisions of bodies of ecclesiastics, who, in advocating the irreverent doctrine that what is inconsistent with facts can be God's Truth, were in reality insisting chiefly on their own claims to reverence.

The trouble has been that this fundamental error, and the errors of detail which have been based upon it, have been treated as though on them religion itself depended, instead of their being the deadweights by which the downfall of true religion has again and again been threatened.

It is hardly necessary to say, however, that science has no quarrel with such passages in those always interesting and sometimes grand old writings as are scientifically unsound. Science no more desires to show that its teachings are an advance on those which seemed plausible and even reasonable in the days of ancient Babylon and Egypt, than the astronomy of to-day desires to show that as a science it is more exact than the astronomy of Shakespeare. There is a great charm in those old-world ideas. Apart from their beauty, they are worthy of scientific study as illustrating the progress and development of the human mind. They suggested highly poetical thoughts to the men of old times—thoughts probably far more impressive than any which have been suggested by the science of our own time, full though it is of beauty and of poetry for us.

But science proclaims her right to pursue her researches altogether unhampered by the ideas of others as to the value of those ancient quasi-scientific speculations. "Why do the [dogmatic] nations furiously rage together and the [unscientific] heathen imagine a vain thing?" If they are right, it is all right; they are bound to come out right in the long run—a result for which they ought to be able to wait, possessing their souls in patience. If they are wrong, they have still more serious occasion to consider their position. Whether science be right or wrong, science can never be justly accused of irreverence. Science reads what she knows to be God's work; and if she err in her interpretation, God who supplied the evidence, and gave to man those powers by which he has been enabled to read it, will not be angry with His creatures' weakness. But they who, not in conscious weakness working for the truth, nor in the darkness seeking out the light, but possessed by the pride of ignorance, claim to denounce their fellow-men's researches, and, loving darkness, confidently call their darkness God's own light—if *these* should be found in error, may not the sin of presumption be charged to them?—though not by science (otherwise occupied), yet by the passionless judgment of pure Truth. The answer of the earnest student of God's laws in nature, under the rebuke of these (the real infidels, since they have no faith in God's work; the real sceptics, since they are ever doubting whether men can safely study God's ways), should be:—

> I claim the right of weakness—I, the babe,
> Call on my sire to shield me from the ills
> That still beset my path, not trying me
> With snares beyond my wisdom or my strength.
> . . . . . .
> Brother, thy heart is troubled at my word;
> Sister, I see the cloud is on thy brow.
> God will not blame me—He who sends not peace,
> But sends a sword, and bids us strike amain
> At Error's gilded crest.
> . . . . . .
> My life shall be a challenge, not a truce!
> This is my homage to the mightier powers,
> To ask my boldest question, undismayed
> By muttered threats that some hysteric sense
> Of wrong or insult will convulse the throne
> Where Wisdom reigns supreme.

ASTROLOGICAL FANCIES.

OLD Paracelsus, explaining, after the confident manner of his day, the claims of astrology to respectful attention, stated that "whereas astronomy deals only with the physical aspect of planets and stars, astrology, nobler and higher, deals with the psychical influences which the souls of the heavenly orbs exert upon the microcosm of man." Observe, man's *microcosm*; nothing short of that. There is something more impressive in the thought that the souls of the sun and moon and planets act not only upon each other, but on the microcosm of man, than even in those sesquipedalian terms of which Guy Mannering made such impressive use in his famous controversy with Dominie Sampson, "signs and planets, in aspects sextile, quartile, trine, conjoined, or opposite; houses of heaven, with their cusps, hours, and minutes; Almuten, Almochoden, Anahibazon, Catahibazon, and a thousand other terms of equal sound and significance." These may overwhelm and stupefy; but for real impressiveness naught can surpass the macrocosmic influences of the celestial orbs on microcosmic man—a conception which it is not given to any man to interpret or understand, whereas Anahibazon and Catahibazon when translated into the vernacular are found to be rather commonplace than otherwise.

But in all seriousness, astrology in its inception was a science—if one ought not rather to call it a religion—deserving of respectful consideration, to say the least. Direct observation was all in favour of the belief that the heavenly bodies influence in a most special manner the fortunes of men. The chief of all the heavenly bodies, the sun, produces such manifest effects both in his daily and his yearly course; the moon seems so obviously powerful over the waters of the sea and in other ways, that it was the most natural thing in the world to assume that the other celestial orbs also have their special influences, though it might not seem quite so obvious what those influences were.

We have, however, to go somewhat farther back for the real beginning of that faith in the powers of the heavenly bodies which so long prevailed among men, and still seems loth to die. There was more in the feeling than the mere result of reasoning applied to observed facts. Astrology was at the beginning a form of animistic religion, and that form which had widest range among the races of men, and penetrated most deeply into their hearts. In the childhood of each race, as in the childhood of the individual man, all natural objects were personified. There was nothing mysterious or perplexing in the process. Every one of us who has a fairly good memory, going back to his quite small childhood, knows just how the personification came about. The young child recognises will and power in all things which seem to act and move of themselves, and retains the idea long after the real source of such apparently independent power of action has been explained to him. The child-man is impressed in like manner with the feeling that all which lives and moves around him acts, as he himself does, in response to the promptings of individual will. He sees, in particular, power outside himself in all that influences his fortunes; and noting, more or less consciously, how the fortunes of the human race are influenced by the processes of nature, he sees, in myriad forms, a "power not ourselves," and not always, apparently, "making for good." The fierce roar of the hurricane suggests a hostile power, and the destruction wrought by the storm confirms the belief in a wrathful being, which has wrought its evil will on men and animals. The crash of thunder and the blasting stroke of lightning correspond in like manner

with the sense of malignant might. The fierce rush of the torrent, the overwhelming destruction wrought by the flood, the fury with which the waves of ocean beat upon the shores or destroy the ships to which men had trusted their lives, all speak of independent powers, destructive and death-dealing. And still more clearly are such powers recognised, still more irresistible do they appear, in the bellowing of the volcano, in the hideous groaning of the earthquake, and in the destruction of thousands of human beings with the stateliest buildings erected by them, apparently by the direct agency of subterranean powers shaking to and fro the solid framework of the earth.

To races impressed, as all human races in their childhood were assuredly impressed, with such feelings as these, the vault of heaven presented a scene still more suggestive of irresistible might. The very calm which seems to reign in the celestial depths enhanced men's sense of the action of constant control, not only over the doings and the fortunes of men, but over all the turmoil and uproar at work when forces nearer at hand exerted for a while their overwhelming yet short-lived forces. The giant energies of subterreanean forces might be more directly suggestive of might than the stately motion of the sun rejoicing as a giant to run his course; the fury of the storm might, while it lasted, seem more terrible than his mid-day heat; cloud masses lowering portentously above men's heads might seem more impressive than the calm blue sky; and the flash of lightning more to be dreaded than the steady lustre of the stars. But those are all short-lasting, and their effects are for the most part transient: these remain year after year, generation after generation; their influences know no weariness; their powers undergo no diminution, and their work is co-extensive with man's domain and as enduring as his race.

Can we wonder, then, if in those days, when the forces of nature, as yet not explained as indicating the operation of law, were worshipped as deities by all human races, the vault of heaven seemed to him the special domain of the most powerful gods, those who from without surveyed and swayed the workings of all inferior powers?—including the fierce energies of the tempest and the flood, the lightning flash and the thunderbolt, the volcano and the earthquake. Beneath that vault, as beneath the dome of the very temple of the gods, men bowed their heads to the rulers of heaven: —the sun, glorious alike in splendour and in power; the moon "walking in glory" and queen over the powers of night; the planets, as they pursued their stately course,

> ——now high, now low, then hid,
> Progressive, retrograde, or standing still.

It was not merely that these orbs seemed to them to move as "radiant Mercuries,"

> Carrying through ether, in perpetual round,
> Decrees and resolutions of the gods:

those orbs *were* gods to man throughout the whole of that long early period of each human race, when as yet the existence of natural laws was not even suspected. Many write in these days about solar myths and lunar myths and star myths, as about nature myths generally, as if the uncultured races of old times, and the uncultured myriads in the times when science was but beginning its career, were moved by special ingenuity to devise stories corresponding to natural processes, to the movements of the heavenly bodies, and so forth. It is far more reasonable, and more profitable too, to think of the uncultured in those days as simply interpreting things as they saw them. Not ingenuity, but extreme simplicity of mind, not profound insight but rather ignorance, must supply the explanation of the earlier ideas of human races. We must try to put ourselves in the position of men who saw all that we see, but knew nothing of what science knows to-day. And we must not be surprised if we find that the mystery amidst which all the phenomena of nature were then involved made men take from the workings of nature their ideas even of religion, in such degree and for so long-lasting a time that the traces of those old beliefs remain still in the ceremonial observances of the best and purest religions of to-day.

And first note that with the men of old times the forces working from outside were regarded as the most powerful. It was because beyond the storm and the flood, the thundercloud, the volcano, and the earthquake, the calm sky looked down unchangingly, that the vault of heaven was recognised as the Heaven-Father. "The great and strong wind that rent the mountains and brake in pieces the rock" had impressed savage races with the sense of power, but even for them "the Lord was not in the wind." And after the wind—as mightier even than the fiercest storm—"the earthquake; but the Lord was not in the earthquake; and after the earthquake, fire; but the Lord was not in the fire." For long ages, however, for generations unnumbered, the Lord was in the high heaven. *There* was the true Olympus, whence the influences of the supreme powers were exerted upon the races peopling this earth.

The heavenly powers thus ruling were ranged in influence according to their distance, which was not regarded as mere distance, but as height and as measuring dignity. The moon was not simply the nearest, but the lowest of the heavenly powers, a position by no means inconsistent with her character as the ruler of the night and queen of the stars. And passing to the other extremity of the scale of dignity, the planet which, as of longest period, they regarded as the outermost, was the "highest" (even Galileo wrote of Saturn as the highest planet—*Planeta altissimus*); and to Saturn, accordingly, was assigned the most potent influence of all. From outside the orbs of all the other planets he seemed to watch and control all their movements, and therefore all their influences. Chaucer caught the right idea of the old astrologers respecting Saturn, when, mixing up rather quaintly the planet and the god, he pictures the father of the gods as telling Venus of his wide path and of his great power (as in some way associated together)—

> My dere daughter Venus, quod Saturne,
> *My cours, that hath so wide for to turne,*
> *Hath more power than wot any man.*

Having naturally been led to adopt the belief that the earth and all terrestrial powers were ruled by the orbs of heaven, and that these orbs were higher in dignity and influence as they were more remote, men of old times sought to ascertain in what special way each of these heavenly rulers made his power felt. The influence of some of them was so obvious that they might well believe it within their power to determine the influence of all. Never did the prospects of fortune-telling look more favourable than in the day when men set themselves the task of endeavouring to ascertain in what special ways Mars and Venus and Jupiter, the swiftly moving Mercury and the slowly moving widely travelling Saturn, affected the fortunes of men.

For as to the sun and moon there could be no manner of doubt. Astrologers had no occasion to ask whether the sun's favouring rays brought wealth to men, since even the earth brought forth wealth at his bidding. It belonged, perhaps, to a very early stage of human development to imagine that the sun ruled when it was day, and was in a sense the god of day rather than the actual bringer of day.*

* A modern story of the Joe Miller type tells indeed of an Irishman who said, "Divil thank the sun for shining in the daytime;

It was, however, by no means so childlike a thought that the sun rules the year, or, rather, rules that half of the year during which he is above the great dividing circle which separates his grave in winter from his throne of glory in the middle summer. The idea of direct physical causation, which in our time connects the sun and the life-giving warmth of summer, belongs to the scientific thought of times so recent that in reality their beginning is as of yesterday. Men would have regarded it as a wild and fanciful notion, if not in some degree blasphemous, to suggest that the sun nourishes the fields in the same way precisely that a fire on the hearth nourishes those around it—by its warmth. Even had that idea been accepted, the actual growth of herbs and flowers would still have appeared to respond mysteriously to solar influences. For men understood as little about plant life in those days as about the laws and nature of heat. Seeing then, as they thought, that the sun exerts mystical influences over the growth and development of the herbs of the field and the trees of the forest, men felt well assured that he exerts psychical influences on the microcosm of man. Herbs yield fruit after their kind, and bring forth their hidden wealth in response to solar rays: men and nations, then, must owe their wealth and prosperity to the mysterious influences of the sun.

As for the moon, passing over the very early teaching which regarded her as ruler of the night—an idea which, as it certainly does not correspond with the facts, led Milton to cause the moon's orb to be painfully diverted from its original and mathematically impossible track—we can see that her sway over the tides would be regarded by all men as indicating a mysterious form of power. When we consider that the tides were not explained at all till the time of Newton, were even by him wrongly explained at the outset of his inquiries, and (owing perhaps to his mistake then) are still wrongly explained in at least ninety-nine text-books of astronomy and geography out of a hundred,* we cannot wonder if a strange mystery was recognised in the tidal sway of the ocean, when, as yet, the law of universal gravitation had not even been imagined. The moon seems also in some way to influence persons of weak mind. It is no idle fancy that lunatics and idiots are influenced by the moon, though it is indirectly, not directly, that she affects them. They are disturbed by the light of the full moon during the night; and, being thus disturbed, their mania or idiocy becomes for a while more marked and manifest.

With regard to the planets—the other planets as they were considered, for the sun and moon were planets in those old times—men could only reason by analogy. Since two of the planets do thus manifestly influence things terrestrial, so also in all probability do the others. All that was necessary was to ascertain in what way each planet acted. And this, they supposed, might be done by careful watching.

Unfortunately, they started with views respecting the influence of each planet leading them to expect certain results, which accordingly they soon persuaded themselves (so prone are men to recognise significance in casual coincidences) that they *had* found. Mercury was a planet hard to detect, swift in his movements, and often hiding himself in the sun's rays; he therefore might well be supposed to influence the fortunes of all men engaged in business requiring craft and subtlety. Venus, lovely on "the daffodil sky that she loves," was naturally chosen as the planet of love. Mars, ruddy and fiery in aspect, and changing strangely also in lustre, seemed an equally appropriate ruler over war. Jupiter, stately in motion, and splendid in aspect, influenced the fortunes of those who have rule and sway over men. And lastly, the sad and slow-moving Saturn suggested evil fortune and gloom.

It was not very wonderful, possessed as men were with these notions, that the observations which they made on the planets confirmed them in their fancies, foolish though these now seem to be, as, indeed, they are in the light of the facts now known.

SHAKESPEARE SELF-DRAWN.

By BENVOLIO.

FIRST PART OF "KING HENRY VI."

AS "Titus Andronicus" presents Shakespeare's first efforts in tragedy, while "Love's Labour's Lost" is the first of his comedies, so the First Part of "Henry VI.," whatever portion we attribute to Shakespeare's pen, must be regarded as presenting his first efforts in English historical drama, which, during the reigns of Elizabeth and James I., had, as we know, a special interest for English playgoers. The very worthlessness of much that we find in this play is instructive, for it shows how intense that national feeling must have been which could enjoy the exhibition of inferior plays such as this, nay, even be moved (as Nash tells us) to tears at the representation of the ill-fortunes of Talbot, Salisbury, and Exeter. It is certain that the value of the old English historic subjects for theatrical purposes had been recognised long before Shakespeare came to London. There can be very little doubt that the greater portion of at least the First Part of "Henry VI." had been already used in its present wording before Shakespeare took part in the representations. And there are good reasons for believing that some time passed, after that, before he was allowed any voice in determining the actual form in which this particular play should be presented. When this happened it is probable that at first he was unwilling to believe that he was himself a much better judge of what was fitting and effective than Greene (his senior by but four years, but by a longer interval as a dramatist), or even than Marlowe, whom Shakespeare (if we can judge by the consideration that imitation is an expression of admiration) seems to have regarded as the most powerful dramatist of his time. Shakespeare was very slow, in all probability, to suggest excisions, changes, or additions. Greene was almost certainly unwilling, Marlowe probably ready, to recognise the true judgment of the younger dramatist—younger, that is, as a dramatist, but of the same age counting by years as Marlowe. Hence, probably, the ill-feeling displayed by Greene in his "Groat's Worth of Wit."

I do not propose here to discuss the question of the share

if he shone at night, bedad, there would be something to thank him for!" But that Irishman, assuming (which seems unlikely) that he ever existed, must be regarded as a reversion to a very remote ancestral type.

* Nothing can be much more amusing to the mathematician than the grave repetition of that supposed explanation of the tides, which begins and practically ends with the statement that under the moon's attractive influence the waters on the side of the earth towards the moon would be raised, and also the waters on the side remote from the moon. This is true, doubtless, precisely as it is true that if a top—not spinning—be set aslant on its peg, it will topple over unless supported; but precisely as this statement would be thought a very unsatisfactory explanation of the reeling of a spinning-top when its axis is aslant, so is the common account of what would happen with the seas were the earth not spinning a most insufficient explanation of the entirely different behaviour of the actual seas. It is not commonly known that instead of *high* water under the moon and opposite, there would be *low* water—but for frictional resistance.

which Shakespeare had in the production of the First Part of "Henry VI." So far as Shakespeare's own character is concerned (about which we are endeavouring to gain glimpses from his plays) it may be said that this particular play tells us more by that which is indubitably not Shakespeare's than by the passages which may with more or less confidence be assigned to him. I have already, however, considered the play in that particular aspect. I shall here content myself by touching on some portions of this play which seem undoubtedly touched by Shakespeare's hand, even if all of them have not come direct from his pen, and contrasting them with others which seem as certainly to have come from other hands.

The first seven lines of the play seem as clearly to come from different pens as the play itself regarded as a whole. It would be absurd to suppose Shakespeare wrote the last two of these seven lines:—

> King Henry the Fifth, too famous to live long!
> England ne'er lost a king of so much worth.

While the four lines immediately preceding might well have come from his pen:—

> Comets, importing change of times and states,
> Brandish your crystal tresses in the sky;
> And with them scourge the bad revolting stars,
> That have consented unto Henry's death!

though there is nothing enabling us definitely to assign these lines to Shakespeare. Greene and Marlowe frequently refer to astrological fancies; and the tone of a later reference of the kind:—

> Mars his true moving, even as in the heavens,
> So in the earth, to this day is not known,

recalls rather Greene's occasionally pedantic affectation of learning (a fault shared also by Marlowe) than Shakespeare's manner.

The following lines read like Shakespeare's work:—

> Expect Saint Martin's summer, halcyon days,
> Since I have entered into these wars.
> Glory is like a circle in the water,
> Which never ceaseth to enlarge itself,
> Till by broad spreading it disperse to nought.
> With Henry's death the English circle ends:
> Dispersèd are the glories it included.
> Now am I like that proud insulting ship
> Which Cæsar and his fortunes bare at once.

The Countess of Auvergne's comments on Talbot are decidedly Shakesperean in tone:—

> Is this the scourge of France?
> Is this the Talbot, so much feared abroad,
> That with his name the mothers still their babes?
> I see, report is fabulous and false:
> I thought, I should have seen some Hercules,
> A second Hector, for his grim aspect,
> And large proportion of his strong-knit limbs.

[Compare with the last two lines Elinor's description of Faulconbridge, "King John," act i. scene 1:—

> Do you not read some tokens of my son
> In the large composition of this man?]

Yet the greater part of the scene between the Countess and Talbot is not at all in Shakespeare's style.

The fourth scene of act ii. is by general consent attributed wholly to Shakespeare. No one else, Greene or Peele, Marlowe or Nash, could have written it as it stands. It presents, too, all the signs of having been produced by one hand and at one time. The quality of the work is uniform and consistent. Thoroughly Shakespearean is the skill (evidently unconscious) with which the characters of Suffolk and Plantagenet, both alike fiery, are differentiated, while Somerset, cool even in his wrath, is strongly contrasted with either, and with Warwick, quiet but resolute throughout. There is perhaps a touch of gentle Will Shakespeare's nature in Plantagenet's "Thanks, gentle sir," specially addressed to the unnamed lawyer, whose tone in the few words he speaks indicates his comparatively lowly station.

Very little in acts iii. and iv. seems like Shakespeare's work. The characterisation of the Maid of Orleans, here as throughout, is not only unworthy of Shakespeare, but wanting in dramatic unity. Yet there are lines which few but Shakespeare would have written in those days. For instance, Burgundy's

> Warlike and martial Talbot, Burgundy
> Enshrines thee in his heart, and there erects
> Thy noble deeds as valour's monument.

And La Pucelle's

> Look on thy country, look on fertile France,
> . . . . . .
> As looks the mother on her lowly babe
> When death doth close his tender dying eyes.

These passages, whether Shakespeare's or not, were certainly not from the same hand which wrote York's silly lament:—

> He dies, we lose: I break my royal word;
> We mourn, France smiles; we lose, they daily get:
> All 'long of this vile traitor Somerset.
> . . . . . .
> Lucy, farewell: no more my fortune can,
> But curse the cause, I cannot aid the man—
> Maine, Blois, Poictiers, and Tours are won away,
> 'Long all of Somerset and his delay.

The fifth, sixth, and seventh scenes of this (fourth) act are certainly not Shakespeare's. Probably the rhymed portion which forms nearly the whole of these scenes is from a pen which produced no other part of the play as it stands. But the first lines of scene 5 read much like Shakespeare's work, and seem even suggestive of Shakespeare's nature:—

> O young John Talbot! I did send for thee
> To tutor thee in stratagems of war,
> That Talbot's name might be in thee revived,
> When sapless age, and weak unable limbs,
> Should bring thy father to his drooping chair.

If Greene, however, did not (to use his own words) "bombast out" the "blank verse" following, I know not who, unless perhaps Marlowe, can have written them:—

> Is Talbot slain?—the Frenchman's only scourge,
> Your kingdom's terror and black Nemesis?
> O, were mine eyeballs into bullets turned,
> That I, in rage, might shoot them at your faces!
> O, that I could but call the dead to life,
> It were enough to fright the realm of France:
> Were but his picture left among you here
> It would amaze the proudest of you all.

Shakespeare certainly never wrote this bombastic nonsense. But very likely Shakespeare added the answers in which La Pucelle ridiculed Lucy's bombast. Possibly it was thus he offended Greene.

The parts relating to La Pucelle in the fifth act we may safely assign to another hand than Shakespeare's. There are some who regard the wooing of Margaret by Suffolk as Shakespeare's; but there are passages in it too feeble and too false to nature to be his work. Some lines are almost certainly his, as Suffolk's:—

> So doth the swan her downy cygnets save,
> Keeping them prisoners underneath her wings.
> . . . . . .
> O, stay! I have no power to let her pass;
> My hand would free her, but my heart says—no:
> As plays the sun upon the glassy streams,
> Twinkling another counterfeited beam,

So seems this gorgeous beauty to mine eyes.
Fain would I woo her, but I dare not speak.
. . . . . .
She's beautiful, and therefore to be woo'd;
She is a woman, therefore to be won.

But no one can imagine that Shakespeare wrote the lines :—

SUF. I'll win this Lady Margaret! For whom?
Why, for my king! Tush! he's a wooden thing.
MARG. He talks of wood. It is some carpenter.

Many parts of this scene, as indeed of others in the play, read like actors' gag, showing rather what was thought likely to please the groundlings than what any of the dramatists of the company could have deliberately written.

MR. DONNELLY'S CIPHERING.

AS the calculation of chances seems to be bewildering to many, and specially imposing when it runs into large numbers, I deem it desirable to caution the non-mathematical community against Mr. Donnelly's truly bewildering and in a twofold sense imposing statements in regard to the evidence of the "law of chances" in favour of his cryptogram. He evidently understands the doctrine of chances as little as he understands the cipher Bacon really invented—or rather, as little as he understood that cipher before the *Pall Mall Gazette* explained to him its working in the capital article, "A Mammoth Mare's Nest." I suppose he understands that system now, though, strangely enough, in his "case for" his "Cryptogram" he nowhere thinks it necessary to explain how he came so thoroughly to miss the sense of Bacon's clear explanation of the five-letter cipher. (In passing I may note a point which the author of "A Mammoth Mare's Nest" omitted to mention, viz., that the passages used by Bacon in illustration of his cipher were originally, like the body of the work, in Latin, so that Mr. Donnelly's ingenious idea of "capitalising" ALL and IS in a passage which chances to contain these words out of the sentence "All is lost," is seen to be singularly ludicrous—the Latin being *Perdita res*, and no such word as *perdita* appearing in the passage quoted by Bacon from Cicero—*Ego omni officio ac potius pietate erga te*, &c.

Mr. Donnelly offers to reveal to the editor of the *Pall Mall Gazette*, in confidence, his fundamental cipher-number, if it be acknowledged that the thousands of words in his story cannot have come out by accident. He illustrates what he takes to be the nature of the chances as follows :—If the number were 740, "there are 739 chances to 1 that the cipher word needed will be the 740th; if, now, the first six words of the Lord's Prayer are found, each of them standing as the 740th word, one after the other, in a composition, there is but one chance against 232,065,922,400,000, or one chance against 232 *trillions*" (our more sensible English system of numeration would say *billions*) "that this could happen by accident." And he goes on to speak of the practically infinite chances against the whole of the Lord's Prayer being found in the same systematic manner.

There is not the least semblance of correctness in any of the statements made in regard to this illustrative case; though I am bound to admit that if there had been, if even every word of the argument were sound, the case would not be in the slightest degree illustrative of Mr. Donnelly's work, so that his position will not be at all weakened (it could not possibly be weaker than it is) by my showing that his chance argument is all (in the Baconian cipher) Chron onhot ontho loyos! as the "Mammoth Mare's Nest" article justly says of the whole cryptogram—a mystic word which, being interpreted, signifies BOSH!

The chance that any particular word will be the 740th (counted from any assigned place) is no more to be regarded as 1 in 740 than as 1 in 10, or 20, or 1,000. Counting any number of words brings us to *some* word, whether we count 10, or 20, or 740, or 1,000; and the chance that that word will be some particular word, named beforehand, is not affected by the number of words we count: it is simply the chance that a word taken at random will be that particular word. This chance depends on the nature of the word itself. We are more likely to be led by our count to such a word as *a*, *the*, *and*, *is*, *it*, or *to* than to such a word as *cryptogram* or *impecuniosity*, because in any composition simple words occur oftener than complex ones. To put a fixed and definite chance down for each of the words *Our*, *Father*, *who*, *art*, *in*, and *Heaven* indicates complete misapprehension of the doctrine of probabilities—even of its merest elements.

One can see what Mr. Donnelly tried to do, fondly imagining he was applying the law of chances. Having six words, he sets the chance of these occurring at 1, or *certainty*, for the first word (since some word *must* be reached to start with), and at $\frac{1}{740}$ for each of the other five. Thus the chance for the six is 1 in 740 raised to the fifth power, or $740 \times 740 \times 740 \times 740 \times 740$. He has gone wrong in his ciphering—naturally—for the fifth power of 740 is 221,900,662,400,000, not 232,065,922,400,000; but this is fair work for Mr. Donnelly, and much nearer than he gets in working out his own cipher system.

Mr. Donnelly shows later his utter misapprehension of the law of chances by inviting us to apply that law to determine how many quintillions there are against one that the coherent words (!) "with his quick wit and his big belly" would come out by accident from his free-and-easy system of counting. The law of chances has no bearing on such a question. One might as reasonably ask that the law of chances should be applied to determine how many quintillions to one there are against the adoption by Bacon of an imbecile cipher-system to hide under a rubbish-heap what we are told he was painfully anxious to disclose; or to find the odds against Bacon's writing in bad Victorian English the feeble and scurrilous twaddle attributed to him in "The Great Cryptogram"; or to determine the chances that Bacon, or even Shakespeare himself, hampered in his writing by the multitudinous conditions imagined by Mr. Donnelly, could produce a noble play; or lastly, to indicate the probability of that man detecting a recondite though semi-idiotic cipher-system who had failed to understand the simple and sensible system really invented (and clearly explained) by Bacon himself.

The real problem in chances involved in Mr. Donnelly's work has been, throughout, simply the following :—

When, at any stage of his progress, Mr. Donnelly has needed a particular word, what has been the chance that, with the varied ways in which he permits himself to count, he will reach that word, making his count apparently correspond with one of those ways (modified by one or other of his various methods)? This chance cannot be determined mathematically, but from such study as men of sense can afford to devote to Mr. Donnelly's work, it is obvious that the chance is at least ten thousand to one.

Per contra, here is another question in chances not mathematically determinable :—

Granted that, as more than one critic has pointed out, "any one can construct any kind of narrative" out of any volume whatsoever, after Mr. Donnelly's fashion, what is the chance that any one else will do it? "*It will be observed*," says Mr. Donnelly in italics, "*that no one has*

yet done it"—except himself. Now that he has done this thing, we may safely infer that the odds are about a thousand millions (the number of the adult population of the world) to one against its being ever attempted again. Let us, at least, devoutly hope so.

A BOTANICAL ATROCITY.

By Miller Christy.

AMONG all the many ingenious contrivances for effecting her various ends which Nature makes use of, none are of a more fascinating interest to the student than those by means of which the flowers of plants are fertilised and their seeds distributed over the ground to spots where they may hope to obtain a foot-hold—or, to speak more correctly, a root-hold.

We are all of us accustomed to speak glibly of the "struggle for existence," and we are apt to think that nowhere throughout the whole wide range of nature is this struggle more severe than in the case of our own exalted species, in these days of excessive "competition" and "over-population." But a little reflection may well lead us to doubt whether this is really so, and even to perceive that the struggle is much keener with many other species than with our own. How many, for instance, of the nine millions of ova found in the roe of a single codfish ever produce a mature fish? How many, again, of the tiny wriggling tadpoles that blacken the margins of our country ponds in spring ever attain maturity as full-grown frogs? And what proportion of the seeds produced by any one plant or tree ever finds itself so fortunate as to be able to take root and grow, unsmothered by the surrounding vegetation? Probably, in all these cases, not the one-hundredth part survives to reach maturity. Were it otherwise, indeed, the ocean would quickly become packed solid with codfish, the land overrun with frogs more numerous than at the time of the second Egyptian plague, and the surface of the soil entirely concealed by a dense mass of impenetrable and tangled vegetation. An "infant mortality" so prodigious, in our own species, would certainly appal even the soulless official mind of a Registrar-General.

If, then, the struggle for existence is so severe in Nature, it can hardly be wondered at that many exceedingly ingenious contrivances have been, in the course of time, devised by plants in order to ensure the wide dispersal of their seeds, so that each may enjoy as good a chance as possible of alighting upon some spot where there is sufficient room for it to germinate into a healthy plant. It may be truly said that, as a general rule, with all living things the chief aim and object of their lives is the perpetuation of their species by means of offspring. With plants this is well shown by the extreme ingenuity of many of the contrivances for ensuring proper fertilisation, and the consequent production of good seed. And it may, I think, be said, with equal truth, that second only in importance to this great function, the production of seeds, comes the proper dispersal of those seeds, to which end many almost equally ingenious devices have been adopted. Very many seeds are furnished with minute hooks which fasten themselves on to the wool of passing animals, and thus accomplish the great end in view; others are peculiarly adapted for dispersion by means either of wind or water; others are scattered broadcast after passing through the intestines of birds; while many plants have actually developed means for throwing their seeds to a greater or less distance. There are even some seeds which, in thus effecting their own ends, do so at the expense of living animals; but no known seeds, probably, employ means more atrociously and barbarously cruel than those employed by the seed of a species of grass, known as *Stipa spartea*, which is excessively common over a large extent of the North-American prairies. Briefly described, this villainous instrument is nothing more or less than an automatic vegetable corkscrew, with an exceedingly sharp point, and capable, by its own action, of boring itself into the bodies of living sheep and other animals, and of finally killing them by so doing.

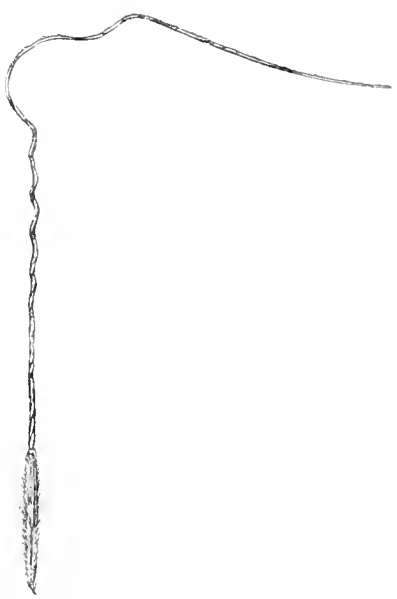
The plant producing this "instrument of torture" has a very wide range of distribution in America. It inhabits the drier portions of the plains and prairies of the west, almost, if not quite, from the Mississippi River on the east to the Rocky Mountains on the west, and from Texas and Mexico on the south to the lonely Peace and Saskatchewan Rivers on the north. The great and only redeeming feature in its character is that, for purposes of pasturage, its leaves are more succulent and valuable than those of any other of the prairie grasses, and that, although too short and tussocky to be made into hay, they formerly provided the buffaloes with their chief winter forage, and now perform the same office for the tame cattle on many a western ranche. On this account it has received, among other popular names, that of "buffalo grass"—indeed, its range in the west of America is pretty nearly co-extensive with the ancient range of the buffalo.

During autumn, winter, and spring, the buffalo-grass is in all respects a most moral and respectable plant; but, early in the summer, it begins to plan evil ways. First of all it throws up three or four tall flower stalks, each about a couple of feet in height, and bearing six or seven of the horrible instruments of torture already mentioned. These ripen about the middle of July, and for the next two or three weeks make themselves troublesome, not only to the lower animals, but also to man, in districts where the plant grows abundantly. It now is fully launched upon its evil ways, and begins to deserve its other popular names, as "spear-grass," "oat-grass," "go-devil-oat," "wild-oat," "needle-grass," &c. As one walks over the prairie at this time of the year, suddenly there comes a sharp prick, as of a pin, on the leg, just above the ankle. Stop one must, to investigate the cause, or the pricking will become more severe, and then the traveller finds that one of these seeds, and very often several, has bored its way clear through one's trousers and sock till it has reached the flesh. With man it is an easy matter to prevent the mischief going any further, but the case is very different with sheep, woolly-haired dogs, and other animals. These cannot rid themselves of the "spears" the moment they begin to prick, and in time the consequences begin to be serious. There is no question that the seeds are able to penetrate the skins, and bury themselves deeply in the flesh of these animals. When this is done, death sometimes supervenes, though oftener as a result of the extensive ulceration thus set up, than as a result of the direct action of the seeds.

Next, a word as to the structure of these unpleasant natural tormentors. In general appearance a complete seed—or, to speak with greater botanical precision, a complete "fruit"—a good deal resembles a twisted piece of wire, having several slight bends in it, and being rather thicker in some places than in others. The seed proper is elongated, brown in colour, somewhat less than an inch in length, and generally not very unlike a harmless oat in its appearance. At one end, however, it is provided with an excessively fine sharp point, surrounded with many delicate barblike hairs, pointing backwards; while at the other end it is produced into a stiff, slender awn, or shaft, rather less than two inches in length. This portion is

usually quite straight, though always sharply twisted up upon its own axis, seven or eight revolutions being usually observable. At the top of the shaft there is a bend, usually somewhat larger than a right angle, which is termed the "lower knee," and in about half an inch another sharper bend, which has been called the "upper knee," after which the awn is still further produced into a stiff tapering bristle, somewhat less than three inches in length, entirely untwisted, and set with many exceedingly minute but sharp teeth, all pointing backwards. The whole apparatus, for such it may be called, is thus about six or seven inches in length. A glance at the accompanying illustration, however, will give a clearer idea of the seed than the most elaborate description.

The foregoing is a description of the instrument when in a perfectly dry state. On its becoming wet, the "hygrometric



Awn of Stipa Spartea (in its dry or twisted state).

action" of the awn (as it is called) comes into play, and the appearance of the whole contrivance quickly becomes changed. The shaft then begins to untwist, the knees commence to straighten, and in a short time the whole awn becomes perfectly straight from end to end, so to remain until it is again dried, when the former twisted and bent condition is resumed. This curious power of untwisting and straightening itself when moistened, and of again twisting up when dried, seems to continue for an almost indefinite time — probably until the awn commences to undergo natural decay. It is a power which is also possessed, though in a less fully-developed degree, by various other seeds. In most, if not all, of the members of the genus *Stipa*, in several other grasses, in some of the Erodiums, and even in the common wild oat, this curious hygrometric peculiarity of the seed is observable.

Let us now examine how this power aids the seed in its nefarious designs. It is in this way: Suppose a ripe awn, in its dry or twisted state, to have become entangled in the wool of a sheep, or to have fallen among the grass. It there remains inactive, until moistened by a shower of rain or a heavy dew. Then, as we know, the shaft commences to untwist, rotating the point of the seed; for, as the bristle or arm of the awn forms at first a right angle with the shaft, it is certain to catch in the grass or wool, and thus prevent the head of the shaft from revolving as it untwists. But all this time, as we also know, the "knees" are straightening, raising the arm and causing it to press upwards. In rising it will probably press against a blade of grass or catch in the wool, its many fine teeth affording it a more or less firm hold upon either. Under these circumstances, the continued efforts of the arm to rise will have the effect of pressing forward the revolving point of the seed, causing it to penetrate slowly and by degrees into the flesh of the animal, the ground, or any other sufficiently soft substance which may be opposed to it. Thus our automatic boring-apparatus will be in full operation. Having penetrated to a slight depth, the barb-like hairs round the point prevent it being withdrawn when the awn re-twists on again becoming dry; so there it remains, ready to penetrate further and further as often as succeeding drought and moisture cause the awn to twist and untwist again.

There is, as has been already said, no question that the seeds are in this way able to penetrate the skins of animals and actually enter the body. On the plains of the West its possession of this power is well known, and I have myself often seen and heard of instances of its effect. I have never, it is true, actually seen a sheep that had been thus killed, because sheep are not allowed to die of it, but are killed for the butcher. There is, however, not the least question that the seeds have the power of causing death, either directly or indirectly. A recent American writer, speaking of this subject, says that, after the seeds have penetrated the skin, "the awns break off, and the needles penetrate the vital part of the sheep, causing painful death. . . . The points, too, not only enter the body of the sheep in this way, but also stick in the nostrils, nose and lips, where, however, they do less harm than when eaten and swallowed into the stomach, in which event death must follow." I have been repeatedly assured when "out West," by butchers and others, that the "spears" are very commonly found beneath the skins of sheep after death—especially about the shoulders—indeed, I have myself seen them in this position, while I have been several times told by settlers of sheep they had been compelled to kill, "to save their lives," as Irishmen are supposed to say. I have, moreover, demonstrated that the seeds do possess this power by experiment in England. Some seeds, which I placed among the wool of two sheep, quickly penetrated to a depth of half an inch, after which I removed them, thinking that the animals were probably less interested than myself in the result of my experiment. Indeed, the keeping of sheep on the Western prairies would be rendered almost impossible, on account of the prevalence of this deadly grass, were it not for the fact that its evil effects can be avoided by a few simple precautions, such as a careful examination of the sheep during the time the seed is ripe, or "folding" them during the same period.

But sheep are not the only animals that suffer. Woolly-haired dogs are almost equally troubled, if proper care be not taken. I have heard of such dogs having, like the sheep, to be killed "to save their lives," when the whole of the breast and stomach has been found to be a mass of ulceration. I have also heard of a colley, which came so thoroughly to understand the nature of the "spears," that he would never enter the long grass while they were ripe; while one settler told me that he had found it necessary to shave his dog all over when the "spears" were ripe, to prevent their catching in his long matted hair.

Now, could any epithet be too strong to describe correctly a seed which conducts itself in such an atrocious manner? I think not. It must, however, be confessed that it is a little difficult to see exactly how the plant is benefited by its seeds being introduced into the bodies of animals. Their dispersal would, it is true, be usually assured, but the great object of that dispersal—namely, germination—would

probably be deterred, unless it be that the seed has some strange power of retaining its vitality for a long period after its burial in the flesh of a sheep. It can hardly be supposed that the seeds are intended to grow there, or we should be presented with the strange spectacle of the sheep growing their favourite food on their own bodies! But this is too absurd. It may, perhaps, be that the simple and beautiful piece of mechanism possessed by the seed of *Stipa spartea* is simply to enable it to bury itself securely in the ground where it may take root—to sow itself, in fact; but, if so, what shall be said of the plant which uses such a power for such murderous purposes as have been described? The whole matter is not yet quite cleared up.

RUDE CENSURES ON BRITISH RUDENESS.

IN the American monthly *Forum* for July there is a paper on English and American manners, by an American rejoicing in the name of T. W. Higginson, the object of which is to show that English breeding is entirely inferior to the American article. Mr. Higginson relates several stories of Englishmen who have been wanting in courtesy, either to himself personally or to other Americans, some of these stories certainly indicating considerable rudeness, though one would like before condemning to know something more of the facts—for it is not absolutely impossible that the discourtesy of the Britisher may have been provoked by equal or greater discourtesy on the part of the American. For instance, a certain lord to whom Mr. Higginson refers may have been wanting in politeness; but when we find the American who undertakes to teach Englishmen manners deliberately naming this lord in his article, telling us how he spoke of his rudeness to an English lady, and quoting her reply that the manners of that family (naming it again) are proverbial, we begin to recognise the extreme probability that the American who thus shows himself ignorant of the essential principles of propriety may have moved the Englishman to be sharp and abrupt with him. In like manner he tells us that a well-known novelist spoke offensively at the table of an American whom he names, and goes on to say that "he took the liberty to sound the Englishman on the subject." The reply suggests pretty clearly that the Englishman had had no thought of offending, but had merely expressed when invited his opinion on some custom approved in America, but not liked elsewhere. "I give you my word of honour," he said, "that I have often felt it my duty to make remarks which were much more offensive to my host than anything I can possibly have said here"—meaning obviously (though I expect the wording of the reply has been altered) that in England he would give his opinion much more decisively, without in any way offending—since in England, when a man's opinion is invited, he is expected to give it truthfully, and no offence is taken if it chances to be unfavourable. But Mr. Higginson, who has offended grossly against propriety in relating the story, and by his own account took a great liberty on the occasion itself, confidently interprets the Englishman's reply to mean that he took pleasure in causing annoyance, and "measured his merit by the degree of annoyance he caused." He adds to the offence by implying that what he charges (unfairly in all probability) against this particular Englishman, all Englishmen are always doing.

Mr. Higginson's whole article is in fact a gross offence not only against manners, but against the principles on which good manners depend. Apart from the rudeness shown to our people, the article is full of offensive and quite unjustified brags about Americans. Mr. Higginson must know that American public schools, whatever other excellent qualities they may have, are not scenes where absolutely perfect manners are displayed (even in the East, while in the West they might be often described in much stronger terms). He must be well aware, also, that if any Englishman cared to follow Mr. Higginson's offensive course and present carefully selected examples of ill manners as correctly indicating the character of a race, he need not look beyond the very circles which Mr. Higginson chooses to describe as trained to perfect manners—the secret societies, with their lodges, chapters, and circles, their gaudy trickery of dress, their preposterous titles, and the rest of their trumpery. It would be most unfair to say that because among the members of these orders you may meet examples of gross rudeness, therefore they are all ill-mannered and discourteous—though not more unfair than it is for Mr. Higginson to attribute to the whole of the English aristocracy the bad manners which he ascribes (probably falsely, since even if he is striving to be fair he is obviously a very poor judge of manners) to one or two whom he has met or heard of. But if one were disposed to be as unfair and as offensive as he seeks to be, one might repeat a sentence of his most effectively (with a slight change in its significance): "Much of the habitual politeness with which Americans of all classes treat one another, in travelling and in business, comes doubtless from the friction and the examples of the lodge-room." Ninety-nine Englishmen of the more cultured classes out of one hundred, who have travelled or done business in America, would be rather disposed to recognise the reverse of politeness as habitual among Americans in business and in travelling—only the hundredth remembering that this is because all classes travel and do business together in America, whereas in England the better bred keep apart from the rougher members of the community. But certainly if an explanation of the "politeness" (negative), that is, of the rough and uncivilised ways very often to be observed among Americans, were to be sought, the reason assigned with another meaning by Mr. Higginson would probably serve.

For my own part, I will frankly admit that I am often exceedingly annoyed with my fellow-countrymen in America, because of what seems to me unnecessary fault-finding. But although I have not been unready to protest against it, both in public and privately, even when it has not been unfair, I must confess that the English fault-finding I have heard about things American has not been comparable for virulence with the American fault-finding I have heard about things English. The ways of (too many) Americans in this respect are well illustrated by Mr. Higginson's article. He rebukes English manners because of a few cases in which, according to his account, Englishmen have not sufficiently admired American ways; and he shows how much he really objects to such want of consideration for American feelings by insulting and abusing England and Englishmen.

Mr. Higginson enters into details to show his sensitiveness. He tells us that no time can reconcile his American ear to the heartiness with which an otherwise well-bred English lady will talk frankly of "tubbing" and "cleaning herself." (One can judge from this in what classes Mr. Higginson has sought for samples of English manners. I will undertake to say that no English lady ever speaks, in social converse, about "tubbing"—I doubt if any English lady ever uses the expression—while a woman who should speak of "cleaning herself" would be set down by an Englishman as undoubtedly a servant-girl, charwoman, or the like. He would not be deceived either into regarding

her as "otherwise well bred," though her breeding might "otherwise" do very well for Mr. Higginson.) This fastidious American is troubled because the most eminent of English poets spoke of some bad verse as "rot," and because Mr. James Payn wrote, "I hate people who 'stink' of money."* *Quis tulerit Gracchos de seditione querentes?* The countrymen of Mark Twain, Bret Harte, Artemus Ward, and a host of others who have written whole pages of coarse buffoonery (but also much exquisite fooling), speaking of a strong word or two from Englishmen is a trifle too rich. Does Mr. Higginson imagine that because Americans have fallen into a habit of regarding particular words with disfavour which in England are used without offence to *express* disfavour, Englishmen are to be called coarse and offensive for using those words as of yore? Before he thus rebukes Englishmen, he should consider the case of his own countrymen, who have taken into favour and use freely certain words which in England have been from time immemorial regarded as improper. [I am simply unable to mention these words, because they are never used in polite society.] I take no exception to their being used in America, where they have no unpleasant significance; but it is simply absurd for one who uses these words freely, and hears the women of his family use them without offence, to be angry with Englishmen for using in their customary significance words which are not offensive to English ears.

Obviously the great fault of English manners with Americans of Mr. Higginson's kind is what is regarded as our thick-skinnedness. In reality an Englishman, though he does not wince or flinch when an American of the ruder sort tries to goad him to anger, feels the blow as keenly as the most sensitive American. But our whole system of training teaches us to take such blows as if we felt them not, repaying them though in due time, and with a serenity which suggests the mistaken notion that the return blow has not been provoked.† In ninety-nine cases out of a hundred, when one hears of British arrogance, he may infer that it has been roused by non-British insolence.

* "Oh, your niceties; I know what they are," said Felix. "They all go on your system of make-believe. 'Rottenness' may suggest what is unpleasant, so you'd better say 'sugar-plums,' or something else such a long way off the fact that nobody is obliged to think of it. Those are your roundabout euphuisms that dress up swindling till it looks as well as honesty." Men like Mr. Higginson would make English readers believe that all Americans are nastily minded. This, however, would be unfair in the extreme.

† In October 1873 I landed at New York for a few hours (our ship having arrived late) with three fellow-passengers and one of the officers. At the Fifth Avenue Hotel we were looking round the large hall in front of the office bureau, crowded as usual with Americans of all classes, from the loafer to the business man. We were soon recognised as Englishmen ("blarsted Britishers," as the polite American expression puts it), and a group of some twenty Americans, any one of whom would have been grievously offended if he had not been regarded as a gentleman, thought the opportunity a good one to divert the profuseness of their blasphemy from things in general to things British, abusing above all the Royal Family and especially the Queen, as a sure way of testing the thick-skinnedness of the Britishers. Our serenity was not disturbed by the cads, who seemed more moved by our silent contempt than they would have been had we met their rowdy ways by rowdy action. Now it so happened that the very next day two of the rowdies presented themselves to me—*more Americano*—on business. I do not know whether they recognised me, as I did them. Anyhow, they did not allow the occasion to pass without asking me how I liked America. When I replied that I had been too short a time ashore to form an opinion, but that it seemed to me the lower classes swore abominably and were exceedingly ill-mannered, they both had grace enough to turn very red with wrath. I am satisfied, however, they described my comments afterwards as due to sheer British arrogance, not to contempt and natural indignation at their conduct overnight.

SCIENCE SHAMED BY GREED OF GAIN.

ENGLISH science has had to be ashamed occasionally of the ways of the scientific mendicant, who, in the course of what he calls the Physical Endowment of Research, has made vain promises and idle boasts, till Science has blushed for the ways of those who use her name for their own purposes. Science does not require her servants to be wageless. As the exponent of religion is not thought to shame religion by holding that the labourer, even in religious fields, is worthy of his hire, so is it with those who, working faithfully in the cause of Science, deem themselves entitled to just wages for their work, without which indeed they might be obliged to turn for maintenance from the work for which they are fit to law, medicine, religion, or commerce. But Science requires that there shall be no false pretences. The work done must be done zealously, and must be worth the wages claimed. Promises which the student of Science knows to be vain—such, for example, as in old times the promise to read or rule the stars, or in our own days to predict the world's weather from sunspots—Science "cannot away with"; and whether the wages asked for worthless work be high or low, the pittance of a country curate or such splendid incomes as our clamourers for endowment have suggested as appropriate, Science regards all such claims as discreditable if not dishonest.

But it would seem that there are deeper depths than any which Science had yet known. None of the advocates of physical endowment have yet, so far as we know, actually claimed money for making suggestions. None of them have claimed a price for time given to the discussion of one of their physical observatories, even when such time has been their own; and I should trust that even the most barefaced among the mendicants of Science would not think of asking such a price for time *not* his own so used, time taken from work in some well-salaried office.

This achievement was reserved for an American scientist. Mr. E. S. Holden, the same man who selected the respectable columns of the *Atlantic Monthly* to make false and libellous personal charges against me, who abused me for being led by the success of my first work, "Saturn and its System" (a dismal failure commercially), to endeavour to get money for literary work, as if that were dishonest, and showed the nature of his purpose by blindly vituperating, as if he had read it, a book of mine which was not published till fourteen years later, this man—so zealous for purity of purpose in scientific work, that he denounced honest work because, as he supposed, it had been successful—has just done that which I venture to predict will stand out in the records of science as the most discreditable act of which any man of science has yet been guilty.

During the last twelve years, Mr. Holden has written certain letters conveying suggestions in regard to the Lick Observatory, which (most unfortunately for science) has been placed in his charge instead of being entrusted to one of the many skilful observers America possesses. He has also made some few journeys of inspection, the expenses of which have in all cases been paid. The time thus employed has in reality belonged to others, since he has all the while held highly salaried office, and latterly has been president of the State University of California, to which the Lick Observatory has been presented.

In the meantime a host of better men, men who know what telescopic work really is, have been ready with valuable advice and assistance. I suppose what Mr. Burnham, for example, has done in this way outvalues fifty-fold anything which has been suggested by the man who at

Washington could do nothing of the least worth with the 26-inch telescope, nothing original at all—except the discovery of an impossible third satellite of Mars, which would make old Kepler turn in his grave if only astronomers would accept it. (They are about as likely to do so as to believe in a total eclipse of a half-full moon.) Every American astronomer worthy the name has been interested in the great telescope, and delighted to do anything in the way of suggestion or assistance to develop its chances of success.

But the Trustees of the Lick Observatory have had a sudden surprise, which might make them unwilling to accept in future the assistance or advice of students of science were they not able to form a tolerably clear idea of the exceptional nature of the man they have to deal with. Mr. Holden has sent in a claim for six thousand dollars for his advice—"services rendered" he puts it. As the Trustees justly point out, if all the rest of those who have helped valued their services at the same rate, the Trust would be bankrupt. They therefore disallow his claim, setting aside 10,000 dollars (from the sum they were preparing to hand over to the University of California) to meet the possible expenses of legally resisting Mr. Holden's suit.

The Trustees of the Lick Observatory believe that Mr. Holden will withdraw his claim. And very likely he will—if his legal advisers tell him he has no chance of getting the money. But whether he withdraw it or not, he can never remove the disgrace which his claim has brought upon science; for a position has been given to him in the world of science—not by any scientific work which he has done (for he has done none of any value), but by the mistake which learned bodies, in England as well as elsewhere, have made in conferring distinctions on him which in some cases they declined to bestow on fellow-countrymen of his (the late Dr. Henry Draper, for example) incomparably his superiors. I repent me that I did not, when, I fear, it was my duty to be out-spoken, prevent, as I could most surely have done, his election to the foreign associateship of the Royal Astronomical Society, a body which must now in some degree share the disgrace which Mr. Holden's claim has brought upon all scientific bodies with which his name can in any way be associated.

THE EARTH'S UNRECORDED PAST.

REGARDING our earth as a member of the solar system—the chief member of that set of so-called terrestrial planets which form the sun's special family—the astronomer studies her with special interest as the one planet which can be thoroughly examined. The work of the geologist becomes on this account especially important to the student of astronomy. He does not require, indeed, to have that detailed knowledge of geological matters which is essential to the student of geology; but, on the other hand, he requires a much fuller and at the same time more exact knowledge of geology than many imagine. He should have, in fact, the same sort of knowledge of geology that Humboldt had of astronomy—a knowledge sufficient to enable him to weigh and appreciate the theories as well as the facts of a science which, though outside his special domain, so closely adjoins it, that without such knowledge the study even of that special domain of his must be imperfect. Fortunately the exact study of one department of science, though it cannot help in itself to enable any one to come to sound conclusions in regard to another, yet surely protects him against the risk of forming unsound or paradoxical theories, for he knows from the study of his own science what is essential to the formation of just opinions in another. Hence the student of astronomy sees that he must study the results of the labours and researches of geologists thoroughly, though generally. He has to take only a bird's-eye view of geology, but the view must be taken from a proper standpoint, so that no illusions may affect its general accuracy, and, moreover, the survey must be complete, not partial.

Let us see how the astronomer is led to study the geology of the earth.

We recognise our earth as having in the beginning of her career passed through that sunlike state whose general conditions we can study in the sun. Doubtless there were important differences of detail, due chiefly to the immense inferiority of the earth in point of size and mass, just as there are important differences between the first stages of an oak's life and the first stages of the life of a fuchsia, between the beginnings of the life of a fly or a bee and those of the life of a lion or an elephant. Still, in all its more general characteristics the conditions of our earth in the earliest stages of her existence as a separate orb were the characteristics of a sun. The greater portion of her mass must then have been in the vaporous state, even the stubborn metals adding their vapours to the complex atmosphere which, in reality, formed then the largest portion alike of her mass and of her volume. Movements akin to those which are taking place all the time in the sun, as well as disturbances akin to those which from time to time alter the aspect of his photosphere, must have taken place in the earth when she was in the sunlike stage of her career.

Later, after millions of years indeed, for it is by such periods we must measure the lifetime of a world like our earth, large portions of the matter which had been vaporous became liquid, and eventually solid. It would be more correct, however, to say that as time progressed a larger and larger proportion of the materials forming the earth's mass became liquid, and a larger and ever-growing proportion solid. For just as even at this day not a single drop of the waters of the sea is permanently liquid, not a cubic inch of the polar glacial masses permanently solid, so must it have been in the earlier stages of the earth's career with the molten materials formed by cooling from gaseous matter, and with much, at any rate, of the solid materials formed by cooling from molten matter. There must have been continual interchange of condition between the solid, liquid, and vaporous states in the case of nearly all the elements and compounds at first, and of the greater number of the elements, until a great advance had been made—which must have required many millions of years—to the state of matters existing now, when oxygen and nitrogen are the only elements free in cosmically large amount, and water the only compound substance which is free to assume in large quantities the vaporous and solid states, in addition to its customarily liquid condition.

The progress of the earth through the second important career of her life as an independent orb was doubtless characterised by a steady diminution on the whole of the proportion of vaporous matter in her mass as compared with liquid and solid matter, and of liquid as compared with solid matter. There must also have been a steady diminution in the number of substances present in large quantities *anywhere* in the vaporous form. In an early part of this stage of the earth's career the metals and metalloids would for the most part either solidify or enter into such chemical combinations as would make them parts of solid bodies. More and more of the surface of the forming earth would thus become solid, though doubtless there was very little perma-

nence in the solid crust formed in various parts of the earth in this stage of her career. Immense tracts of liquid surface would solidify through some relatively slight changes of temperature or other conditions; but the crust thus formed would be fissured from time to time by the seething liquid masses beneath; and often large regions of fiery hot crust would be converted suddenly into the liquid condition through the action of currents of hotter matter rising underneath them. Or, as large fields of ice are carried now by oceanic currents into regions where they are melted by the warmer waters around them, so in those earlier days of the earth would immense tracts of glowing crust be carried to regions where they would melt in the fervour of the hotter liquid beneath them, and resume the liquid condition out of which they had for a time passed.

Among the substances now mostly liquid which must have been almost wholly vaporous throughout the second stage of the earth's orb-life, water of course must be regarded as the most important. Water could not have rested, in the liquid state, on the intensely hot surface of our earth in this part of her life. It is true that the atmosphere must have been far more dense then than now, because it must have included immense quantities of gaseous and vaporous matter not now present in it except in very small amount: and under such an atmosphere water might be heated till it shone with its own inherent light, without being converted into steam. But the temperature of the crust must have been greater even than this would imply. And though a few lakes and pools of red hot water may have gathered from time to time on the ever moving white hot crust of the earth, yet far the larger portion of the water must have been vaporised, forming a vast atmosphere of steam, which close by the earth's glowing surface would be self-luminous. At considerable heights above that surface the steam would condense in the form of visible clouds, not self-luminous, but lit up on their inner side by the fiery surface of the crust beneath. Probably several layers of clouds would form at different heights. The lowermost layer would give off vapour from its upper side, to rise to a greater height, and form by fresh condensation another layer, only illuminated by such light from the crust as passed between the clouds of the lowest layer. And the process would probably be repeated in such sort that several layers would be formed enclosing the earth's real globe at different distances from its glowing surface. What the depth of the complex atmosphere of the earth in that stage of her career may have been, it is not easy to determine. For what we know of the sun and (less certainly but still clearly enough) of the giant planets, shows that the laws of the gaseous pressure and density prevailing within such limits as bound the experiments of our physicists, do not hold at the high temperatures and tremendous pressures existing certainly in the sun and giant planets, and almost as certainly in our earth's dense atmosphere when she was in the first two stages of her planet life. To show that this is so, it is only necessary to note that, whereas terrestrial experiments have taught that there is a critical temperature for each gas, at higher temperature than which no amount of pressure will produce liquefaction, were this true of the sun, not only would every particle of his substance be vaporous, but density increasing with pressure in gases and vapours (except where liquefaction is approaching, which is not here the case), the compression would be so great even a few thousand miles below the visible limits of his atmosphere that the density even of hydrogen would be greater many times than that of platinum, the heaviest element known on earth. We not only know that this is impossible, but that the mean density of the sun, instead of being thus enormous, is only about a fourth of the mean density of the earth. We can infer from this that under the conditions existing when our earth was in the sun-like and fiery stages of her career, an atmosphere of great extent, with probably many successive layers of cloud, surrounded her fiery globe, whose partly liquid partly solid surface, though glowing with a white heat, probably could pour no portion of its light through the enwrapping cloud-masses.

We may also confidently infer that in the earth's deep atmosphere in this earlier stage of her life, vertical movements of great energy took place, as immense volumes of compressed vapours (not steam alone) were flung upwards with tremendous energy in volcanic explosions, or as cloud masses in which whole seas of water were contained gave birth to cataracts (rather than torrents) of intensely hot water, strongly charged with destructive acids. We may have to look to other planets for evidence that such vertical displacements do actually take place during the earlier stages of world life. Yet, reasoning on what our earth's condition must have been at such stages in her life, or on what it would now be if she were placed as in some vast crucible and heated throughout her whole frame till her crust shone white again, we see that vertical movements of both kinds, eruptional or upwards and torrential or downwards, cannot but have been constantly in progress throughout her deep, complex, and cloud-laden atmosphere. Such movements, by altering the distance of the moving masses from the axis of rotation, would cause either a lagging or a relative advance of these masses amongst those into which they were ascending or descending respectively—in other words, bands or zones of vaporous or cloudlike nature, akin to the zones of Jupiter and Saturn, formed in the deep and complex atmosphere of the earth at that stage of her orb-life.

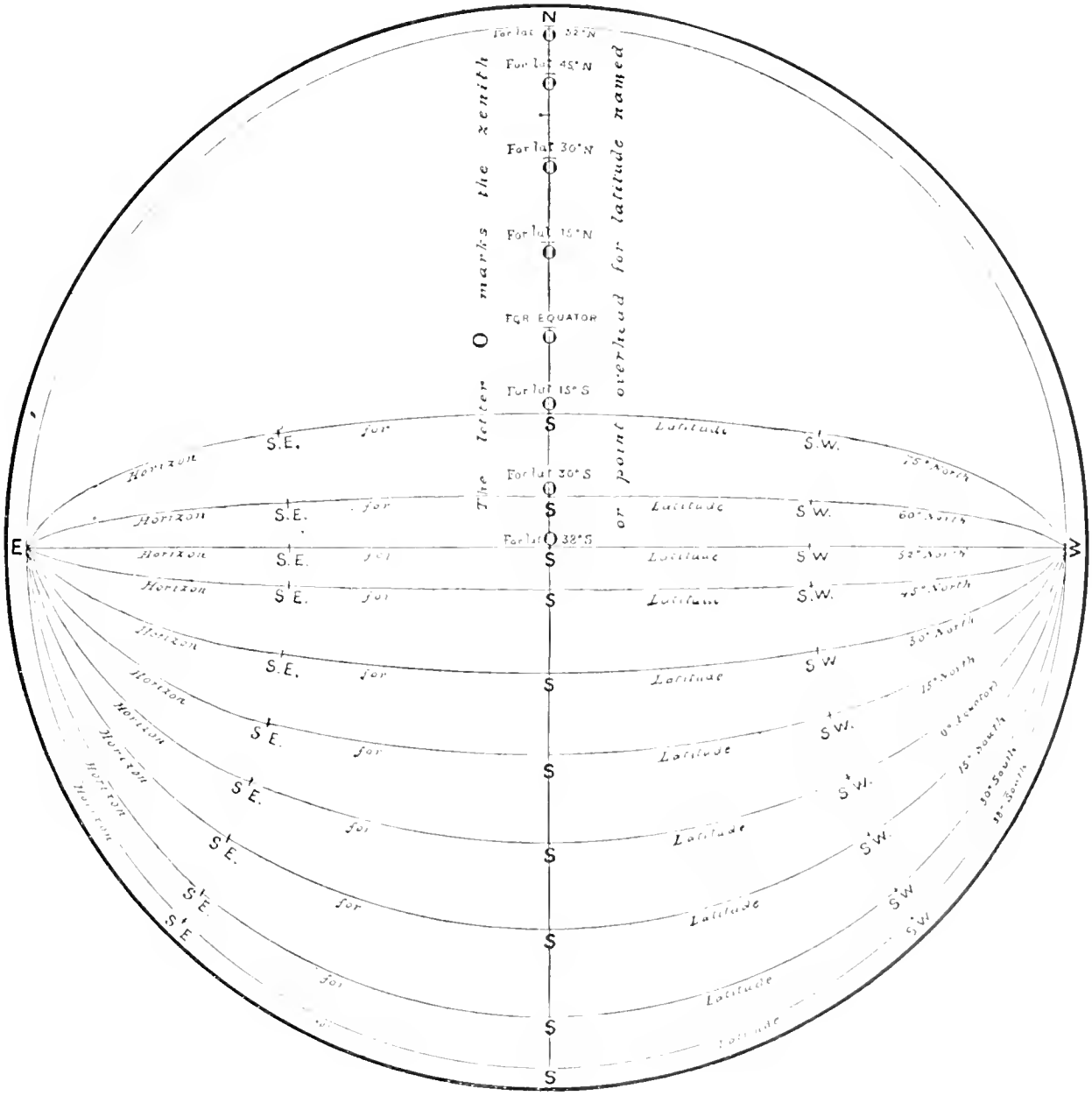
After millions more of years the earth became ready to enter on that part of her existence which may be called her life-bearing career. Not everywhere on her surface at once, but in certain regions—possibly the polar portions—where the cooling was first sufficient, certain lower forms of life, scarcely distinguishable then as vegetable and animal, would be possible. Apparently the conditions which rendered them possible were also such as to bring about their generation—we know not how, and still less do we know why. Multitudinous germs of life, not necessarily multitudinous in form, possibly including but a few forms, possibly but a single form, must have appeared on the earth in a very early portion of the present stage of her life—millions of years probably before the era to which geologists attribute the Archæan or most ancient rocks of the earth (preceding those called primary by geologists), for from such germs alone could the forms of life which we recognise in the fossils of the lowest of the primary rocks have been developed. So much we are assured of; but as to the manner in which such germs of life came into existence, and the way in which the property we call vitality came to belong to them, we know no more than we do of the manner in which the materials of which suns and planets have been formed came first to be, or of the way in which those materials came to have the specific properties which we know they possess.

It is not even from the stage thus reached, remote in the past as it must be, that we can trace the earth's record. Millions of years must have passed before the simple primordial forms of life, animal and vegetable, had developed (along certain lines) into the specialised and often highly complex forms found in the lowest of the geological strata. Of the interval we have scarcely even any records in the material changes which took place as the Archæan rocks were forming. It is scarcely to be hoped that any traces of life of that ante-primary era will ever be discovered, so unfavourable were all the conditions for the preservation of animal or vegetable remains.

KEY MAP TO THE SOUTHERN SKIES.

THE accompanying map is intended for the use of those who possess the series of twelve Southern Maps which were completed in KNOWLEDGE for January last. If a tracing were made on sufficiently transparent paper, this tracing placed over any one of those maps would serve to indicate where the southern horizon, with the several points E., S.E., S., S.W., and W., falls for the latitudes named. But a better plan is for the observer in any of the latitudes mentioned to cut out a piece of paper in the form of an arc, the upper edge of which corresponds to the pictured are for that latitude. Then having marked the above-named cardinal points along it, he can bring the east and west ends of the arc to coincidence with the points E. and W. on proper map for the date and hour of observation. The stars seen in the chart along and above that arc will then be the stars above the horizon from east through south to west at the observer's station.

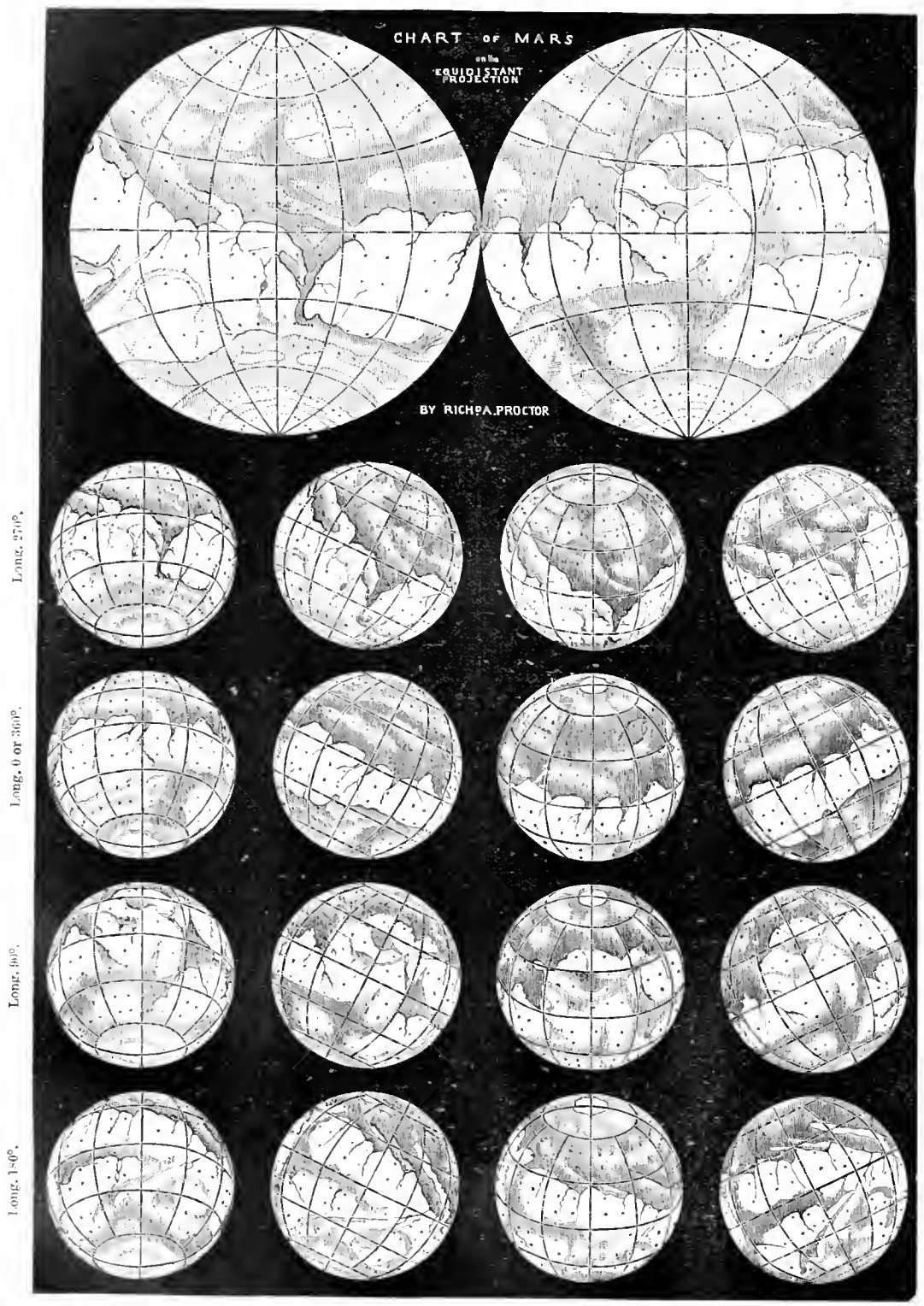
Thus will the maps serve to show the stars over far the greater part of the heavens visible from northern latitudes, and all the stars visible in southern latitudes from the equator to the most southerly inhabited regions.



MAPS AND VIEWS OF MARS.

I GIVE this month the long-promised map of Mars, accompanied by what may be called a picture map, and by a series of projections showing Mars not as actually seen on any special occasion, but as he would appear if my maps are correct, the air of Mars free from clouds, and observing conditions favourable; only I have included meridians and latitude-parallels which have not yet, I presume, been marked by Martian races on the surface of their world, though so to mark them would be child's play compared with the construction of those double canals in which Signor Schiaparelli and M. Perrotin believe.

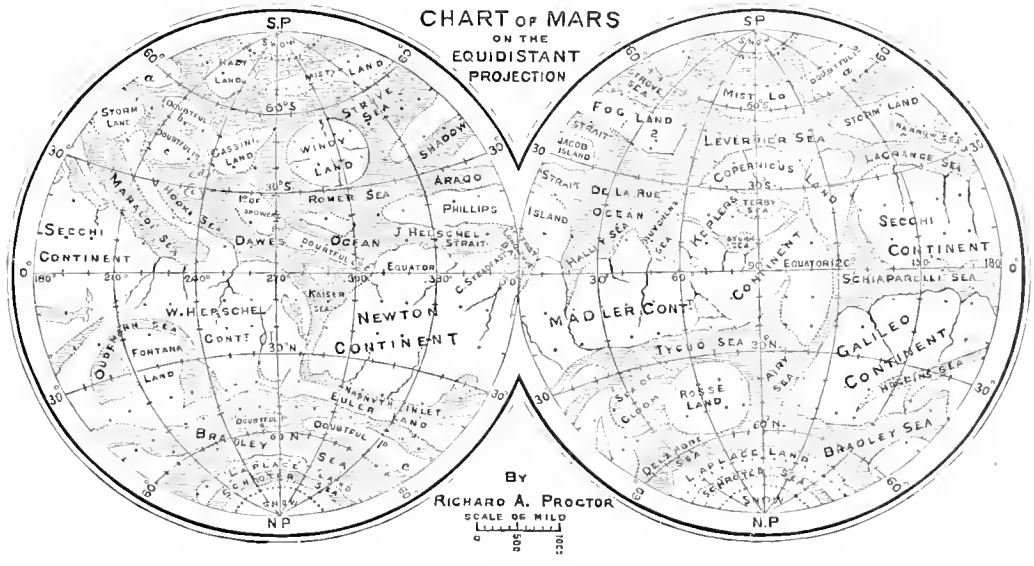
The maps and projections require no explanation. The history of the researches which have led to the determination of the various features of the planet will be found in part viii. of my "Old and New Astronomy," to be published on November 1.



MIDSUMMER (Southern). VERNAL EQUINOX (Southern). MIDWINTER (Southern). AUTUMNAL EQUINOX (Southern).

I may remark, however, with regard to the names which I have used for indicating continents and seas, that while in the main I have followed the nomenclature adopted in my former chart as corrected in that respect by Mr. Green, I have not adopted all his changes, and I have introduced some changes of my own. I never intended my first nomenclature to be definite; indeed, I adopted it merely for convenience of reference in a work of my own on the planet—planned like my "Saturn and its System," but not accepted by publishers as likely to be commercially successful, so that "my poverty but not my will" forced me to withdraw it from an unappreciative community. Mr. Green was quite right in pointing out that some names were used too often—Mr. Dawes's name, for instance, was given to a Continent, an Ocean, a Sea, an Island, a Bay, and so forth. That was all very well for my plan, but not in a chart for general reference. Mr. Green altered and added freely; somewhat too freely, indeed, doing what has always seemed to me undesirable, in crowding in a number of names of living persons (my own included), after a fashion recalling Mr. Birt's preposterous additions to the names of lunar craters. In omitting many of these I have taken the opportunity to substitute unobjectionable names (which may be regarded as only temporary) for some of those which had been unsatisfactorily named in my former chart. Mist Island, Windy Land, Cloud Land, Cape Steadfast, Gloomy Sea, and the like, are names which, while altogether free from objection in themselves, correspond with the actual appearance of the features named.

Of Signor Schiaparelli's classical nomenclature I can only say that, judging from what one hears when papers are read or discussed at the rooms of the Astronomical Society, there are not nine of Schiaparelli's names out of ten which would be properly pronounced, even if observers and astronomers generally could be expected to fix in their memories a series of sesquipedalian and, for the most part, entirely unmeaning names. The nomenclature belongs to the affectations by which men of science, who ought to have known better, have brought ridicule on science and on themselves. *Machina Pneumatica* for a constellation, *Margaritifer Sinus* for a Martian feature, *Chromosphere* and *Leucosphere* for solar appendages, and all such absurdities, should have no existence among sensible students of science.



MANX AND WELSH FAIRIES.

By Stella Occidens. (Mary Proctor.)

> In oldè dayès of the King Artoûr
> Of which the Breton spoke great honoûr,
> All was this lond fulfilled of faërie;
> The elf-queene with her jolie companie
> Danced full oft in meny a grenè mede.—Chaucer.

THE fairy folk-lore of the Isle of Man, which was early peopled by the Celts, is very like that of England. Their fairies are called Good People, though they scarcely deserve this name, since from all accounts they are the most mischievous imps in existence. They steal little children out of their cradles, leaving ugly changelings in their place, and are also very fond of taking midnight rides on stolen steeds, which the owners find in the stable next morning covered with foam and sweat, and nearly tired to death.

The Phynnodderee, or Hairy One, of Man, is like the Brownie or Kobold, and his story is a sad one. When he should have been in attendance at the Fairy Court on the occasion of the *Re-hollys vooar yn ouyr*, or harvest moon, he was dancing in the merry glen of Rushen with a pretty Manx maiden. For this grave offence he was banished from Fairyland and doomed to wander about the Isle of Man till Doomsday, in a wild form, covered with long shaggy hair. He is a good-natured spirit, often helping farmers to cut hay or drive cattle home before a storm. On one occasion he carried some huge blocks of stone from the beach to a place near the foot of Snafield Mountain, and the owner rewarded him by leaving a whole suit of clothes in one of his favourite haunts. The Phynnodderee, on finding them, lifted them one by one, singing dolefully meanwhile:—

"If these be all thine, thine cannot be the merry glen of Rushen," and, giving a melancholy wail, he disappeared and has never been seen since. The old Manx folks say "there has not been a merry world since he lost his ground."

An account given of a fairy banquet in Man recalls the well-known legend of the "Luck of Edenhall." It is related that a farmer was returning home across the fields one evening, when he heard sounds of music in the dis-

tance. Presently he came to a band of little folks who were feasting merrily, and who persuaded the farmer to join them. He did so, and was much surprised when a little man plucked him by the sleeve, and warned him not to taste anything that was placed before him. "For if you do," said the little man, "you will be as I am, and return no more to your family." The farmer followed his advice, and when a silver goblet was handed to him, he spilled the contents on the ground. At daybreak the music ceased, and the fairies vanished, leaving the farmer with the silver goblet in his hand. He returned home, feeling very tired, and next day he went to the parish priest for advice with regard to the silver goblet. The latter told him that he had better give it to the church, and it is still to be seen in Kirk Merlugh.

Fairies and hobgoblins are firmly believed in still by the peasantry in the southern counties of Glamorgan, Carmarthen, and Pembroke. The fairies are called y Dynon Bach Teg, i.e. *The Little Fair People*. The bells of the foxglove are called elves-gloves, and the mushroom, elves-food. These little beings are supposed to be the souls of the ancient Druids, who were not quite good enough to go to heaven, nor bad enough to go to the other place; so they are allowed to wander about till the Day of Judgment, when they will join the ranks of the elect, and "read their title clear to mansions in the skies."

They are very fond of music and dancing, especially on bright moonlight nights. A story is told about two farm-servants, called Rhys and Llewellyn, who were returning home from their work in the twilight. Hearing strains of music, Rhys could not resist dancing, and in a moment had danced far ahead of his companion. The latter, on arriving home without Rhys, was suspected of murder, and thrown into prison. Luckily, a farmer who was well acquainted with fairy-lore, believed Llewellyn's story, and told him to lead him to the place where he had heard the music. They came to the spot, which was "green as mountain-ash," and, as Llewellyn stepped within the magic-circle, he heard the most enchanting strains, and beheld Rhys amid a merry band of dancers. His friends had to use all their strength to pull him out of the ring and force him to return home. He was not at all pleased at their interference, insisting that he had only been dancing for five minutes, and was not ready to go home yet. He became melancholy mad, and died a short time afterwards, it is said; and the next morning one of the villagers, who passed near the fairy-circle, "found the edge of the ring quite red, as if trodden down," and the marks of little heels the size of a thumbnail.

These fairies are fond of hunting, and have been seen riding on little white horses no bigger than dogs, whilst the sound of a bugle-horn and the huntsman's halloo could be plainly heard. A man who was crossing over Bedwellty Mountains one night heard sounds of music, and in a moment was surrounded by fairies. Having heard that they will disappear at the sight of cold steel, the man drew out a knife and they instantly vanished. In the same way fairies who have married mortals have been known to disappear on being touched with iron. A man who had married a fairy tossed a bridle to his bride, and, the bit touching her, she flew through the air at once, and plunged headlong into Corwrion Lake.

A similar legend is told about a most romantic spot among the mountains of Carmarthen It is called "The Van Pools," and is said to be haunted by "the spirit of the Van." She appears at midnight on New Year's Eve, and is said to be "dressed in a white robe, bound by a golden girdle. Her hair is long and golden, her face is pale and melancholy; she sits in a golden boat, and manages a golden oar." She had married a farmer on condition that he should never know her name, or strike her, especially with iron, for he would then lose her for ever. After a little while he forgot his promise, and on two occasions, when she had vexed him, he struck her. The third time they were ploughing together, he guiding the plough and she driving the horses. The horses going wrong, the farmer threw something at them which hit his wife, and in a moment she disappeared beneath the waters of the Lake Van Pool.

A man who wished to see the fairies made an appointment with an old gipsy to meet her by moonlight on the top of Craig y Dinis. She washed his eyes with a wonderful lotion, helping him to see thousands of little beings all dressed in white, and dancing to the sound of harps.

"They then placed themselves on the edge of the hill, and, sitting down and putting their hands round their knees, they tumbled down one after another, rolling head over heels, till they disappeared in the valley." For some time the sound of their harps could be heard, gradually dying away in the distance.

A mischievous little being called Pwcca, resembling our English Puck, used to haunt Wales; and in Brecon there is a spot called Cwm Pwcca, or Puck's Glen, where he is still to be seen.

A man who was returning home late one night saw a little wee man a few yards ahead of him carrying a light. He followed him, and Pwcca (for it was he) led him to the very edge of the precipice Cwm Pwcca, when, holding the light high above his head, he gave an impish laugh and vanished in the valley below, leaving the man in utter darkness.

The Welsh fairies are like the Irish with regard to stealing babies out of their cradles, leaving ugly little changelings in their place. In Brittany a similar belief prevails. There was constant intercourse at one time between the inhabitants of Wales and those of Lesser Britain, as it was then called; in fact, the Bretons and British were of one blood, so that their fairy folk-lore is almost the same.

In Glamorganshire a legend is told which is not unlike the following related in Brittany:—

A mother whose child had been stolen by the fairies prayed to the Virgin for help. She was advised to "prepare a meal for ten farm-servants in an egg-shell," which will make the Korrid speak; she is then to whip him till he cries, and when he does his mother will come and take him away. The mother did as she was told, and when the changeling saw the strange meal prepared he exclaimed: "I have seen the egg before I saw the white hen; I have seen the acorn before I saw the tree; I have seen the oak in the wood of Brézal, but never saw I such a thing as this." "Thou hast seen too many things, my son," replied the mother, and she began to whip him, when his mother came to her crying: "Do not beat him, give him back to me; I have not done yours any injury. He is king in his own country." When the mother went home she was rejoiced at finding her own child asleep in the cradle.

The Breton fairies are divided into two classes—the Fays or Korrigans, and the Dwarfs or Korreds. The Korrigans are beings two feet high, with long flowing hair, which they are always combing carefully. They wind a long white veil around their bodies, and at night their beauty is ravishing; but in the daytime their eyes appear red, their hair white, and their faces wrinkled [even such tales have been told of some ladies of the *corps de ballet*]. The Korrigans, though fond of music, do not care much about dancing. Once a year, on the first of May, they have a great feast, during which a crystal goblet is passed around, and those who drink the magic potion it contains become all-wise and can foretell the future.

The Korrigan is like the Elle-maid of Scandinavia, and

in the same way the Korreds resemble the Trolds. They are short and stumpy, with shaggy hair, small deeply-set eyes, and wrinkled faces. Their voices are thin and cracked, their hands like a cat's paws, and their feet are horny like a goat's. They are spiteful and vicious. They are very fond of dancing, but woe to the belated shepherd who comes across them during their midnight revels! They dance around the *dolmen* (stone-tables, also called by this name in Devon and Cornwall), and any one who is forced to join in their roundel must keep it up till cockcrow. The poor victim "is mercilessly whirled about till he falls down breathless and exhausted, amidst the peals of laughter of the dwarfs, who all vanish at break of day." *

Breton folk-songs tell us of underground passages called querlich's holes or Korred's grottoes, where great treasures are kept. Sometimes the dwarfs take them from one place to another; and if any one passes by at the time they are allowed to take a handful, but no more. Should a rash mortal venture to fill his pockets the money vanishes, and he "is assailed by boxes on the ear from invisible hands."

A Breton farmer thought he would try his luck; and one moonlight night, when the dwarfs were absent on a gay frolic, he stole some treasure out of a Korred's hole. He hastened home, and hid it under some tiles in the kitchen floor, afterwards covering the whole place with burnt ashes and embers.

About midnight the farmer heard the little imps creeping in stealthily through a hole in the wall. But what a howling and lamentation they set up when they trod on the burning embers. The farmer chuckled to himself at their discomfiture, but his mirth was soon changed to consternation when they revenged themselves by smashing every piece of crockery he possessed. At daybreak they all vanished, saying, "In Iannik-ann-Trevon's house we burnt our horny feet; but we made a fine mess of his crockery." †

NORTH ATLANTIC ICEBERGS.‡

ICEBERGS are a great source of danger to Transatlantic navigation from March to August every year. This is the season in which the expected proximity of these dread masses of ice demands from the mariner an increased vigilance. Sometimes, but very seldom, bergs have been fallen in with much earlier. On New Year's Day, 1844, a berg was passed by the *Sully* in 45 N. 48 W., and this year, on January 3, one was reported in almost the same position. The northern ice barrier is broken up by the increasing power of the sun's rays as he travels northward along the ecliptic. Fields of ice, sometimes having an area of one hundred square miles, are detached, and a free exit afforded for the imprisoned icebergs. Icebergs and field ice are borne to the southward by the cold current that follows the bend of the land from Labrador to Florida. Field ice is formed on the sea surface during the Arctic winter, but bergs have their origin far inland, and are the growth of years. Greenland glaciers glide gradually down their gentle slopes into the sea, and the upward pressure of the water breaks off their snouts to form the icebergs of the North Atlantic. Some hardy Norwegians are about to cross Greenland, and intend to make a special study of the movement of the coast glaciers and this setting afloat of bergs. Ancient glaciers have written their story on the mountains of Great Britain, and bergs were formed a little way off the west coast of Ireland during the glacial epoch.

There exists a marked difference in form between the bergs of the two hemispheres. Arctic bergs are of irregular shape, with lofty pinnacles, cloud-capped towers, and glittering domes, whereas the southern bergs are flat-topped and solid-looking. The former reach the sea by narrow fiords, but the formation of the latter is more regular. It is well to give these splendid specimens of Nature's handwork a wide berth, for they frequently turn somersaults owing to the wasting away of their immersed portions. Immense pieces of ice fell from a berg on to the deck of a ship that had approached too close to it while in this transitory state, carrying away her masts and maiming some of the crew. Again, ships have been sunk by colliding with submerged portions of bergs, extending from their visible volume like reefs of rocks from a bold sea coast. Hayes compared one that he saw to the Colossus of Rhodes. His ship could have sailed under the arch of ice formed in the heart of the berg.

North Atlantic bergs are neither so large nor so numerous as those met with in the Southern Ocean, between the Falkland Islands and the Cape of Good Hope. In 1854 55 an enormous ice island was drifting in about 42 S. 24 W., for several months, and was passed by many ships. It was 300 feet high, 60 miles long, and 40 miles wide, and was in shape like a horseshoe. Its two sides enclosed a sheltered bay measuring 40 miles across! A large emigrant ship, the *Guiding Star*, sailed into this icy bay and was lost with all hands. A similar but smaller mass of ice was met with in the North Atlantic by the *Agra*. She ran into a bay formed in the centre of an iceberg, in 42 N., which was 1½ mile across, and she experienced great difficulty in beating out again.

A cubic foot of ice weighs about 930 ounces, but the same volume of sea water weighs 1,280 ounces. Hence ice floats on water, and but one-ninth of the volume of a berg is exposed to view. There are several well-authenticated instances of bergs one thousand feet high having been sighted in the Southern Ocean, so that this would give the total height of them as about nine thousand feet!—a fairly good-sized mass of solid water. In May last year the *Inchgreen* passed close alongside of a berg that Captain Miller estimated had an altitude of seven hundred feet above the sea surface and was seven miles long. Bergs have often been seen grounded on the banks of Newfoundland, where the deep-sea lead gave a depth of 650 feet. Ross saw several stranded in Baffin's Bay, where the depth was 1,400 feet.

Bergs are unusually numerous in some years, and a connection is said to have been traced between the frequency of bergs in the North Atlantic and the low temperature in our islands during the summers of some years. The ship *Swanton* passed three hundred bergs in 1842 in 43 N. 50 W. She narrowly escaped destruction during the night, as she passed between two huge bergs that almost grazed her sides. Captain (afterwards Rev. Dr.) Scoresby, while whaling in the northern icy sea, counted no less than five hundred bergs under way for the open waters of the Atlantic. Last June the steamship *Concordia* passed seventy-eight large bergs in a short space of time, as they lay aground in the Straits of Belleisle. This year the ice is both late and scarce; in 1883 it was very abundant. No forecast can be made as to the probability of frequency of bergs. A vessel has been so firmly fixed in the ice in the month of March in 44 N. 45 W. that her master was able to take a stroll on the ice. In 1841 several ships, stopped by ice in mid-

* Grimm, "Teutonic Mythology," p. 466. In Norse legends reappears the trick of engaging a Trold in conversation till the sun is risen; when he looks round and sees the sun he splits in two. The same occurs in the story of Rumpelstilzchen.

† Keightley's "Fairy Mythology."

‡ From the *Liverpool Journal of Commerce*.

Atlantic, availed themselves of the opportunity to kill some seals that were basking upon it.

Bergs have been seen in the North Atlantic laden with lumps of rock, sand, and soil. The banks of Newfoundland would appear to have been formed in this way. Arctic lands suffer denudation by the inland ice as it creeps along towards the sea, and the bergs, separated from their parent glaciers, deposit the fragments at the bottom of the old ocean, there to harden into rocks and help in moulding the surface of the coast. Nothing is lost, nothing is new. In August 1827 a berg was observed stranded in eighty-five fathoms in 46½ N. 45 W. Much earth and rock were embedded in its fissured sides. Polar bears and other Arctic animals were seen on the bergs of 1883. An abandoned ship was passed high and dry on a huge ice island in 1794, and a ship with her crew was seen similarly situated in 1845; but no help could be afforded. On April 21, 1851, the brig *Renovation* passed an immense ice island, about ninety miles to the eastward of St. John's, Newfoundland. Two dismantled ships lay snugly upon it, but there was no sign of life. Captain Ommanney, R.N., was deputed to investigate this report, and took great pains to arrive at its truth, as it was inferred that these ships were the *Erebus* and *Terror*, of Sir John Franklin's ill-fated expedition. Some people are still of the same way of thinking. The crew of the German discovery ship *Hansa* were compelled to abandon their vessel, crushed by ice, and took refuge on an immense floating mass of ice, where they remained for eight months. Their floating ice island was seven miles in circumference, and drifted south, until the poor fellows were able to make their escape. During this time they had lived in a hut constructed from the coal saved from their ship. H.M.S. *Resolute* was abandoned embedded in the ice, but was picked up after a long drift to the southward. This ice-bearing current tends to make the American coast very cold, and, as we write, Sydney, C.B., is not yet open to navigation, although it is 7 degrees further south than Liverpool. The warmer water of the Gulf Stream, on the other hand, enables the whalers to get far to the northward, on this side of the Atlantic, and makes the mean temperature of Ireland in 52 degrees N. as high as that of American coast ports in 38 degrees N., 14 degrees nearer to the equator.

Many losses and casualties were caused by the ice in the North Atlantic last season. Masters should take frequent observations of the temperature of the sea, although it must not be relied upon as a specific indication. Warning may often be obtained by means of the echo given off from a berg when a steam whistle is sounded. No precaution must be neglected by those who navigate our floating palaces and ocean tramps, but the safest plan is to adopt a southerly route clear of bergs. The *Etruria* has followed this course in her fastest passages. Our Admiralty charts show the seasonal limits of bergs, and the United States Hydrographical Office issues charts every month giving the exact position of each berg up to the moment of going to press. Notices of bergs passed at sea should be forwarded to Washington immediately on arrival, and every berg reported to us will receive due publicity in our columns.

EASY PROBLEMS IN THE DIFFERENTIAL CALCULUS.

IN KNOWLEDGE for July I suggested as easy exercises, to be dealt with by the differential calculus, and then geometrically to show the superior generality of the former method, these two:—

To determine (i.) *the cylinder of greatest volume; and* (ii.) *the cylinder of greatest surface, which can be enclosed in a given sphere.*

Let P Q R S be a cylinder enclosed within the sphere A C B D, M O K being the axis of the cylinder.

Let the angle P O B be taken as our variable, and put $\angle P O B = \theta$. The construction of the figure (omitting for the present the dotted lines) and its lettering needs no explanation. Then, if r is the radius of the sphere,

$$P L = r \sin\theta;\ O L = r\cos\theta;\ \text{and}$$

(i.) Vol. of cylinder $P R = \pi r^2 \cos^2\theta \,.\, 2r\sin\theta$

$$= 2\pi r^3 \cos^2\theta \sin\theta,$$

and the differential coefficient of this expression with respect to θ gives us the equation

$$\cos^3\theta - 2\cos\theta\sin^2\theta = 0,$$

$$\text{or } \cos\theta = 0;$$

$$\text{and } \cos^2\theta = 2\sin^2\theta;\ \text{or } \cot\theta = \sqrt{2}.$$

Wherefore for a maximum O L should exceed P L, as $\sqrt{2}$ exceeds 1, or as a diagonal of a square exceeds a side [$\cos\theta = 0$ obviously gives a minimum value].

(ii.) Area of cylinder P N,

$$= 2\pi r^2\cos^2\theta + 2\pi r\cos\theta \,.\, 2r\sin\theta$$

$$= 2\pi r^2 (\cos^2\theta + 2\cos\theta\sin\theta),$$

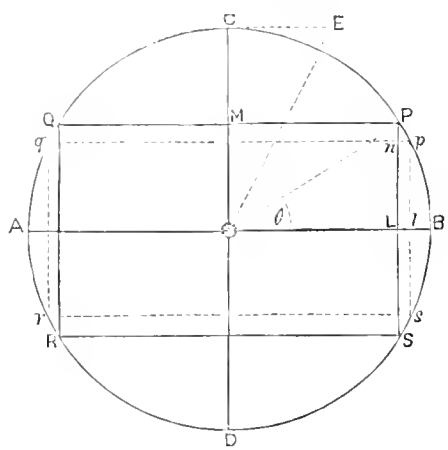
and for a maximum we must have

$$-2\cos\theta\sin\theta - 2\sin^2\theta + 2\cos^2\theta = 0,$$

that is, $2\cos 2\theta = \sin 2\theta$; or $\tan 2\theta = 0$.

So that if we draw the tangent C E = ½ O B, and join O E, O P must bisect the angle E O B.

To solve the same problems geometrically, complete the



dotted construction representing $p\,q\,r\,s$, a cylinder coaxial with P Q R S, and having very nearly the same dimensions.

Then, first, if P Q R S has the maximum volume, the increment and the decrement in passing to the cylinder $p\,q\,r\,s$ are ultimately equal. Hence

$$2\pi\,O\,L \,.\, L\,l \,.\, 2n\,L = 2\pi\,(M\,P)^2 \,.\, P\,n,$$

$$\text{or } 2\,L\,l \,.\, n\,L = M\,P \,.\, P\,n = O\,L \,.\, P\,n.$$

$$\therefore \text{ (since } n\,L = P\,L, \text{ ulty.), } \frac{2\,P\,L}{O\,L} = \frac{P\,n}{l\,L} = \frac{P\,n}{n\,p} = \frac{O\,L}{P\,L},$$

$$\text{or } \left(\frac{O\,L}{P\,L}\right)^2 = 2;\ \text{and } O\,L = \sqrt{2}\,P\,L \text{ as before.}$$

The geometrical solution in this case is easy enough, as it chances. In the following case the geometrical solution is decidedly inferior to the analytical. For the area of the cylinder, equating the increment to the decrement, we have—

$$2\times 2\pi \,.\, OL \,.\, np = 2\,.\,2\pi\,.\,2\,(PL\,.\,OL - pl\,.\,Ol),$$

or $OL\,.\,np = 2\,[PL\,.\,OL - (PL - nP)\,(OL + Ll)]$;

$= 2\,(nP\,.\,OL - PL\,.\,np)$; neglecting $nP\,.\,Ll$, as ultimately evanescent compared with the other terms in the equation.

$$\therefore \frac{PL}{OL} = \frac{2nP - np}{2np} = \frac{2OL - PL}{2PL}$$

(by similar triangles Ppn, OPL) or $2(OL^2 - PL^2) = OL\,.\,PL$;

$$\text{whence, } 2\left(\frac{OL}{PL} - \frac{PL}{OL}\right) = 1,$$

$$\text{i.e., } 2\cot POL - 2\tan POL = 1;$$

whence $2\cos^2 POL - 2\sin^2 POL = \cos POL\,.\,\sin POL$, the same relation as by the other method, since $POL = \theta$, but obtained in a far less satisfactory manner.

The student will find it a useful exercise to deal next, first by the differential calculus, and next by geometry, with the following problems:—

Determine the cone of maximum area (i.) *without including base, and* (ii.) *including base, which can be enclosed within a given sphere.*

A correspondent in Bombay calls my attention to some supposed misprints in my "Easy Lessons in the Differential Calculus." One or two of these cases are real misprints, too easily to be detected, however, to require correcting, the rest are mistakes on my correspondent's part. He asks further this question:—It is stated on p. 14 that if we know the rate of increase of a quantity s (as another, t, varies) to be a certain quantity gt, and also know this quantity gt to be the differential coefficient of another quantity $\frac{gt^2}{2}$, with respect to t, we can at once write

$$s = gt^2 + \text{some constant.}$$

How, asks my correspondent, can this be regarded as obvious? The answer is that the differential coefficient of a quantity with respect to another has been already defined to be the rate of increase of the former as the latter varies. So that such a statement as my correspondent finds difficult is in reality akin to such a statement as the following:—If we know that the rate of increase of a certain property per annum is 250*l.*, and also know that the only portion of the property invested at 5 per cent. shows this annual increase to be the interest on 5,000*l.*, we can at once write

The property = 5,000*l.* + a constant portion bringing in no interest.

Gossip.

By Richard A. Proctor.

Mr. T. Fraser is very anxious that I should deal with certain difficulties which have occurred to him in reading my "Old and New Astronomy;" and he is apparently not aware how fully the consideration of these difficulties will show the unlikelihood of his being able to deal with the overwhelmingly difficult problem of the cause of gravity, which he has made the subject of a pamphlet. I will endeavour to discuss matters for him.

* * *

First, he asks me how I can reconcile my statement in "Old and New Astronomy" that were the eccentricity of the earth's orbit to disappear she would move in a circle having a *diameter* equal to the *major axis* of the elliptic orbit, with my statement in Knowledge that "if the direction of a planet's motion when the planet is at its *mean distance* is right, it will travel in a circle having that mean distance for *radius*." Considering that the mean distance in an elliptic orbit is equal to half the major axis, while the radius of a circle is half the diameter, the two statements seem to me to be rather obviously identical.

* * *

In sec. 502, p. 215, the words "fig. 139" *are*, as Mr. Fraser points out, a misprint, rather obviously for "fig. 142." If an author, in his anxiety to be understood, adds new figures to make his original explanation more complete, it will occasionally happen that all the references to the figures whose numbers get altered will not be corrected. Still, no reader who is really interested can, in such cases, be for a moment misled; and every such reader will prefer full illustration to mere precision of references to illustrations manifestly insufficient. As the number of figures in "Old and New Astronomy," including plates, will run to over six hundred, the ingenuous and generously minded reader will perceive that there is more room for an occasional slip (not really disturbing the student's progress for a moment) than in works where the illustrations are counted only by tens or twenties. Mr. Fraser's supposition that H H′ in section 503 should be *h h′* is mistaken.

* * *

Mr. Fraser objects to the use of the same letters, accented or unaccented, capital or small, in such cases, as they involve a strain on the memory, because you have to say "capital H," "small *h*," "accented H," "unaccented *h*," and so on—whereas he does "not know any argument by which the practice can be defended." "Excuse me, if I seem to lecture you," he proceeds (I very readily do), "but this has been on my mind for some time, and I feel better for the removal of the load." I apprehend he ought rather to say, "Do not smile if I seem to lecture you," for he is writing of a matter about which, as he practically admits, he knows nothing; whereas I have had occasion to study it carefully. The argument by which the practice is defended is that these repeated letters always represent associated things. Thus the mathematician calls the two ends of the major axis of an ellipse A and *a*, or A and A′; the two ends of the minor axis B and *b*, or B and B′; the two foci S and S′ (if he sometimes writes H for one focus it is because, while S is the first letter for the sun, H is the first letter of Helios, the Greek name for the sun). No mathematician, I imagine, ever thinks of saying "capital H" and "small *h*;" at least I never trouble myself to make such changes in reading any one else's mathematical demonstrations; neither do I say "non-accented H" and "accented H," but simply "H" and "H dash." However, if Mr. Fraser's mind feels free of a load, what more can be desired?

* * *

"But now," continues Mr. Fraser, "I come to a matter which has been on my mind for a very long time, in fact ever since 1881." I promised to deal with the tides, and Mr. Fraser "is sorry to tell" me "that after reading a part," and a part only, of what I say in Part IV. of "Old and New Astronomy," he is "in as great a fog as ever." He "happens to have invented the centrifugal theory for himself," and so takes "a fatherly interest in it." Seven years ago he thought himself the first inventor of it. And "I always thought it an extraordinary coincidence," he proceeds, "that in the same number of Knowledge in which I expected some notice of it to be taken, appeared a review of Professor

Newcomb's book in which the same theory appeared. I seem to be wrong in more directions than one lately; but if those with knowledge" (with a small k) "do not distribute it to those without, how can the circulation of KNOWLEDGE" (with a very large K) "be maintained?" (Very neat, Mr. Fraser.)

* * *

The trouble is that both the fallacy and the correction are so exceedingly old that readers of KNOWLEDGE might justly complain if any considerable amount of space were given to it. The oldest edition of Lord Grimthorpe's "Astronomy without Mathematics," which I possess, is the fifth, dated 1874, and in that work the fallacy is presented and the proper correction pointed out. Doubtless in earlier editions the same matter (in substance) will be found; and as the paradoxists are always with us, I doubt not the matter will continue to be dealt with in later editions, or, as it were, indefinitely. Precisely the same fallacy is advanced with regard to the sun by Mr. W. Mattieu Williams, old Sol being pictured in "The Fuel of the Sun" as constantly stirred up by centrifugal forces, which have no existence, and in variations of such forces, which are purely mythical. That book came out in 1869. Mr. Henry Perigal, however, had been earlier yet caught by the mistake, in the moon's case, as had Bentley more than a century ago, so that Mr. Fraser in 1881 need only have been astonished at Newcomb's making the mistake, for the same reason that all mathematicians were astonished. (Professor Newcomb long since recognised the mistake he had made and corrected it like a man.)

* * *

I can only find space to state here that the earth's rotation round her axis results in equal centrifugal tendency all round, producing the earth's oblateness of figure, while her monthly revolution around the common centre of gravity of the earth and moon would by itself cause every particle of the earth to traverse an orbit of exactly the same size. (Combining with it the rotation, all whose effects have been accounted for, cannot affect this.) The centrifugal tendencies resulting from the movement of the several particles in these equal orbits are balanced by the moon's attraction, with only such differences as the old statical explanation of the tides indicates in the moon's action on parts of the earth at different distances from the moon. These differences are small, and taking them into account as balancing the lunar attractions is merely repeating in a disguised form the old-fashioned explanation, which is altogether correct so far as it goes, and has never needed to be displaced, only added to—precisely as an explanation of the reeling of a top, which began by saying that the slanted top is solicited by gravity to topple over, would not have to be displaced (since so far it is right), but extended in such sort as to explain why the top thus solicited by gravity does *not* fall over (while its rotation lasts). The other idea of a centrifugal force, as if the earth revolved round the centre of gravity of earth and moon with the parts farthest from that centre travelling round the wider paths, would correspond to a state of things in which tides thirty times higher than the actual tidal wave would sweep over all terrestrial shores—precisely as the motion Mr. H. Perigal imagined for the moon would have effects far beyond any actually taking place, and as the kind of centrifugal stirring up imagined by Mr. Williams would be many times more than sufficient for the stoking work which Mr. Williams wants it to do.

Reviews.

Nature's Hygiene. By C. T. KINGZETT, F.I.C., F.C.S. Third Edition. (London: Baillière, Tindall, & Cox. 1888.)—Every one is now familiar with the type of advertisement which begins, "At the time of the exile of the Duc de Choiseul on account of the notorious Madame du Barry"; or, "Among the many witty sayings of Sydney Smith which have been recorded"; on reading which to learn what happened anent the mistress of Louis XV., or what the famous Canon of St. Paul's really did say, we suddenly find that we have been entrapped into the perusal of an invitation to rub our aching joints with St. Vitus's Vinegar, or to scrub ourselves, our sons and daughters, our menservants and maidservants, our cattle and the stranger that is within our gates, with Appel's Sapolica, and so on. Now Mr. Kingzett's book is modelled on this form of advertisement, and it says but little for our critical acumen that we had got something like half-way through the volume before making this discovery. We must do its author the justice, however, of admitting that the interest of his ostensible subject, and his manner of treating it, irresistibly carried us into the middle of what we may call the business part of his book before we detected this. In short, he winds up a most interesting account of the nature of malaria, of the germ and graft theories of disease, of the treatment of sewage, and of the general sanitary conditions indispensable to the preservation of health, with a puff pure and simple of "Sanitas," a disinfectant of his own invention produced by the oxidisation of turpentine. His work might be divided into two parts with advantage.

Nature's Fairy-Land. By H. W. S. WORSLEY-BENISON, F.L.S. (London: Elliot Stock. 1888.)—In a series of picturesque essays, Mr. Benison leads us through woodlands, over heaths, by hedge, copse, and stream, and takes us for a ramble on the seashore. In the course of our wanderings we are taught a good deal of botany, some physics (in the shape of a description of the formation of rain and of the action of waves), and have something of the manners and customs of fishes and molluscs, spiders and flies, explained to us. This pretty little book may well be put into the hands of young people in whom it is desired to create or foster a taste for an innocent and engrossing means of recreation. Some of Mr. Benison's teleological remarks might perhaps be omitted with advantage, as there is, to us, something offensive in the assumption that finite man can penetrate the motives of the Almighty.

Early Prose and Poetical Works of John Taylor, the Water Poet. (London: Hamilton, Adams, & Co. 1888.)—In the year 1580 there was born in the city of Gloucester, of humble parentage, John Taylor, subsequently self-dubbed "The King's Majesty's Water Poet," whose earlier works have been collected by the anonymous editor of the volume before us. Of limited education, he was apprenticed to a Thames waterman. During a part of his life he served in the navy, and he also seems to have held some sort of post in the Tower of London, winding up his career as landlord of the "Poet's Head" in Phœnix Alley, Long Acre. He was essentially of a nomadic temperament, having during his career travelled from London to Edinburgh on foot, a journey described in his "Penniless Pilgrimage" in the volume before us; from London to Hamburg, of which we have also his account here; from London to Salisbury in a wherry, whereof he tells here, too, under the title of "A New Discovery by Sea," and so on. His "poetry" is of the school of the poet Close, being but of a doggerel character. It is largely interspersed with prose. He seems to have been a comparatively illiterate man, with strong though

uncultivated powers of observation, and possessed of a share of coarse humour which was more appreciable in the Jacobean age than it is in the Victorian one. As affording a picture of life in Tudor and Stuart times this edition of Taylor's works may be read both with advantage and profit.

Percy Bysshe Shelley: a Monograph. By H. S. SALT. (London: Swan Sonnenschein, Lowrey, & Co. 1888.)—Mr. Salt has given us a really readable and agreeable, if somewhat partisan, history of the remarkable poet and original thinker who flashed like a meteor across the sky of the early part of the present century. He retells, always in Shelley's interest, the story of his marriage with Harriet Westbrook, and of his subsequent connection with Mary Godwin, carefully suppressing much that was wholly indefensible, and exaggerating everything for which any excuse can be advanced. It is this too obtrusive advocacy, and the absence of anything approaching the judicial spirit, that weakens the effect of so much that our author advances in Shelley's defence; while every now and then his blind admiration of his idol's Socialistic opinions betrays him into the expression of ignorant utterances concerning Ireland, which will only excite derision in those personally familiar with that unhappy country. The true history of Shelley has yet to be written.

At Evening Time it Shall be Light. By LEWIS LAURISTON. (London: The London Literary Society.)—In this wishy-washy religious novelette Mr. Lauriston, like others of his school, constructs his own giants with the express view to their subsequent demolition. "The Hon. Edward Fanshawe," who is an agnostic of the most feeble type (and whose obvious incapacity to give a reason of the hope that is in him renders his opinions after his conversion as valueless as those he professed before it), loses his wife, and subsequently his son, while holding materialistic doctrines, and is plunged into despair. While in this state he wanders into a church where a mission service is going on, and hears a man utter a string of evangelical platitudes—and so on. Those who care for "goody-goodiness" must consult the volume itself to learn what happens to Mr. Fanshawe at the end of it.

The Life, Times, and Writings of Thomas Cranmer, D.D. By CHAS. HASTINGS COLLETTE. (London: George Redway, 1887.)—Professing, and undoubtedly intending, to write in a strictly impartial and judicial spirit, Mr. Collette's evangelical principles cause him to view the whole story of the Reformation through coloured spectacles; and to convert him, posing as a judge, into a fervid and altogether one-sided advocate. Nor does it make any difference in the attitude he assumes that the evils of Popery are unhappily but too undeniable, and that we have only to enter any country whatever under priestly domination to find sloth, filth, and degradation, physical and intellectual, rampant. That Cranmer was a potent factor in the English Reformation blinds our author to all his faults and shortcomings, and prompts him to invent a series of excuses for various acts now become historical, which we venture to think he would scarcely otherwise have cared to justify, and which assuredly he would have reprobated in Gardiner or Bonner. But, having said this, we would add that Mr. Collette's work should be read by every one whose ideas of Cranmer's life are derived from such sources as Dr. Littledale's "Ritualistic Innovation," with its low and vulgar scurrility and abuse. The reader approaching the subject with no prepossession will study both, and strike a mean between them. And the partisanship which detracts from the weight of our author's estimate of Cranmer is perhaps even more apparent in his defence of Henry VIII., whose acts and motives are alike presented in a light which would scarcely bear the ordeal of any searching historical criticism. When, after much pestering, the old woman got her minister to pray for rain, and a hailstorm came and cut up all her cabbages, it is recorded that she exclaimed, "Ah! that's just like Mr. Jones—he always *ov rdoes* everything!" May we hint that, in this respect, Mr. Collette has been taking an easy lesson from Mr. Jones?

Ballads of Books. Edited by ANDREW LANG. (Longmans & Co.)—Whoever possesses Mr. Ireland's "Book-Lover's Enchiridion," with its gems of thought on the solace and companionship of books gathered from ancient and modern writers, from Socrates to Louis Stevenson, should not fail to put this delightful anthology of verse in praise of books, from Catullus to Dobson, by its side. The one volume is complementary to the other.

Our Sentimental Journey. By JOSEPH and ELIZABETH ROBINS PENNELL. (Longmans & Co.)—As none of the dead authors to whom Mr. Lang addressed his letters have shown signs of offence at the liberty thus taken with them, Mr. and Mrs. Pennell have felt emboldened to dedicate this book to the late Mr. Laurence Sterne, whose route by the old post road from Calais to Lyons they followed, and whose title to his volume of travel they have unblushingly appropriated. But they may rest assured that the Recording Angel of whom that reverend sentimentalist and plagiarist discoursed will drop his tear upon their peccadillo and blot it out for ever. They have told the story of their journey on a tandem tricycle in language which has an apposite old-world flavour. They deserve all the enjoyment which they got out of the trip, for what with drenchings, head-winds, damages to the machine, whose wheels, like those of Pharaoh's chariots, "drave heavily," especially when the top of the oil-can came off, so that "the can was in the oil instead of the oil in the can," and other drawbacks, their course did not run smooth. The map of France is very droll, and the sketches are admirable in their vividness and delicacy.

Vere Thornleigh's Inheritance, by A. M. HOPKINSON; *The Trance of Fitzerse*, by ALFRED FITZERSE; *They Twain*, by MARY H. PICKERSGILL-CUNLIFFE. (London: The London Literary Society.)—In "Vere Thornleigh's Inheritance," Miss (or Mrs.) Hopkinson tells how a young woman of gentle birth was brought up by an aunt in an old manor house (in reality her own, though she was ignorant of it) to do farm-work, the said aunt and a woman-servant called Hannah being its only other occupants. Not wholly satisfied with her lot, and in utter ignorance of her parentage, Miss Thornleigh wanders out to an unoccupied house belonging to some people named Tresidder. To her there enter (as the old stage directions have it) one young man, one ditto woman, and one older woman, all singing parts from an opera. These are the Tresidders, who have lost their way to their own house. Vere directs them, and, catching up their song, walks home only to find her aunt in a fit. The old lady dies without revealing the secret of her niece's origin. That niece is found the next morning by a barrister friend of the Tresidders absorbed in grief, and Tresidder *père* volunteering his aid, discovers a pocket-book in a chest in the cellar, containing the name Le Mesurier, which he promptly secretes. Then Miss Thornleigh goes to live with the Tresidders. How the secret of her parentage is subsequently discovered, and her aunt's irrational behaviour more or less satisfactorily explained; how she meets her mother, and how happily the story all ends, the reader must go to the book itself to ascertain. He will find it superior to the run of ordinary novels, and decidedly more interesting than our *précis* of its improbable opening incidents would induce him to anticipate.

"The Trance of Fitzerse" has fairly puzzled us, as, after the most attentive and deliberate perusal of it, we wholly

fail to discover what its author is driving at. If the part relating to the Stuart period in Pinnock's "Goldsmith's History of England," an essay by Dr. Littledale, any of the productions of Messrs. Blavatzky, Olcott, Sinnett & Co., Limited, an odd number of "Light," and a chapter from Carpenter's "Mental Physiology," were passed through a sausage-machine, "The Trance of Fitzerse" might well emerge as the result of the combination. Whether the author of this curious hash intends it as a psychological study, and as a more or less accurate narration of a peculiar form of mental alienation, or whether he has been addling himself with the drivelling nonsense of "Spiritualism," and really believes that the incongruous and inconsequent series of occurrences of which he tells might have happened, we cannot divine. Of plot—in any legitimate sense of that word—there is none. A Fitzerse, whose father loses his life in the cause of that perjured and worthless ruler, Charles I., studies medicine at Padua, performs experiments in transfusion, and makes a bosom-friend of a certain Sal Tara Lal, studying under the pseudonym of Saltario, and who subsequently appears in London as Dr. Salter at the time of the Plague. This extremely uncanny person was—or is—a Yogi, or Mahatma ("for which," to paraphrase the immortal Cap'en Cuttle, "overhaul your Blavatzky, and when found make a note of"), and he bottles up, so to speak, all Fitzerse's vitality, and throws him into a trance in the seventeenth century from which he does not rouse until near the end of the nineteenth, only to find himself occupying the place of one of his own lineal descendants. It is not surprising to learn that he is sent to a private asylum as the result of an endeavour to impress the truthfulness of the narrative we have sketched on his friends. We must say, though, that they carried their incredulity very far on the occasion when the author, wholly ignorant of, and without the slightest ear for, music, extemporaneously performed a brilliant capriccio on the violin which he must have learned in Italy about 1658 or so. The book, as we have previously said, has no plot. A variety of characters appear and disappear, having no connection with the story, and in nowise helping it. Our pervading impression after its perusal is that its author has made notes of various incidents that their archæological correctness may give an air of vraisemblance to his tale, and has emptied them bodily into his pages, with a fine disregard for congruity. As a novel the book is worthless: but it will somehow repay reading for all that.

Of "They Twain" we may say, as the schoolboy did of the milk-and-water, "This is indeed weakness!" A young woman of the middle class, who has been brought up amid such refinement as is involved in five o'clock tea and dinner at night, marries a farmer, and has her feelings hurt and her affections estranged by his plebeian habit of taking his principal meal at midday, and so on. By-and-by her child dies, she becomes reconciled to the manners and customs of the agricultural classes, and they live happily ever afterwards. *Voilà tout!*

Of works of a more miscellaneous character we have already the second edition of Mr. S. R. BOTTONE'S capital *Electrical Instrument-making for Amateurs*, the first of which we noticed on page 212.—*Mining and Quarrying*. By J. H. COLLINS, F.G.S. 2nd Edition. (London: Crosby Lockwood & Co. 1888.)—A first-rate little manual for the beginner.—*The Medico-Legal Journal*. (New York: March 1888.)—A serial of considerable interest to all who study medical jurisprudence: containing, *inter alia*, a somewhat maudlin article by Dr. Bleyer on "The Best Methods of Capital Punishment," with a report to match from a committee.—*Hylo-Idealism or Auto-Centricism*. By (H. L. C.). (London: Watts & Co.)—"Crambe repetita" of Dr. Lewins's craze.—*A Special Constable's Story and other Tales*. By HENRY CHARLES MOORE. (London: Wyman & Sons. 1888.) Sketches-by-Boz-and-water.—*Annual Reports of the Aeronautical Society of Great Britain for* 1885–86. (London: Hamilton & Co.)—Containing much that is visionary.—*Electricity* v. *Gas*. By JOHN STENT. (London: Swan Sonnenschein & Co.)—An enthusiastic prediction that coal gas and mineral oil as sources of light will disappear before electricity. Page 56 is nonsense pure and simple.—*The Theory of the Tides*. By JAMES NOLAN, F.G.S.A. (London: Dulau & Co.)—Worth reading.—*Internationales Archiv für Ethnographie*. Edited by J. D. E. SCHMELTZ. Band I. Heft III. (London: Trübner & Co.)—Fully sustains its interest. The illustrations are as beautiful as ever.

We have also on our table the two concluding volumes of Miss AMY BAKER'S *First History of the English People* (London: Swan Sonnenschein, Lowrey, & Co. 1888), bringing the narrative down to Queen Victoria's Jubilee; two or three tracts by Mr. LAURENCE HARGRAVE devoted to flying machines; their very full and complete *Catalogue of Photographic Apparatus* from Messrs. J. Lancaster & Son, Birmingham: divers tracts from the National Association for the Promotion of Technical Education; *The Report of the Superintendent of the American Nautical Almanac* for the year ending June 30, 1887, a record of a mass of valuable work; *Physical and Industrial Training of Criminals*. By HAMILTON D. WEY, M.D. Records of an attempt to place the confirmed scoundrel in a position of very great advantage over the merely honest hard-working man; Ἄσβεστος. By ROBT. H. JONES. (London: Crosby Lockwood & Co.) A description of the localities where asbestos is found, the method of obtaining it, and the uses to which it is put; *Cassell's Technical Educator* (London: Cassell & Co.); also among various educational works, *Competitive Examination Papers in Pure Mathematics* (Stages I. III.); *Letters, Themes, and Essays for Composition*, and *Short Stories*, selected by J. M. LAINE, M.A. (all from Moffatt & Paige); *Hints to Calculators* and *Sensational Arithmetic*. By H. BULL. (London: Hamilton, Adams, & Co.) Devices for making every man his own Bidder or Zerah Colburn; and *The Elements of Logarithms*. By W. GALLATLY, M.A. (London: Francis Hodgson.) An excellent, thoroughly plain and practical little manual.

THE FACE OF THE SKY FOR SEPTEMBER.

By F.R.A.S.

THE spotless sun is wholly void of interest as an object in the telescope. Towards the end of the month the zodiacal light may be seen in the east before sunrise. September 22 is the theoretical date of the equinox: but equality of day and night in London will not occur until the 24th. Map ix. of "The Stars in their Seasons" exhibits the aspect of the night sky. Minima of the variable star Algol ("The Stars in their Seasons," map xii.) will occur at 11h. 26m. P.M. on the 14th, and at 8h. 15m. P.M. on the 17th, as well as on other occasions more inconvenient for the ordinary observer. Mercury is an evening star, but is poorly placed in Leo and Virgo for observation. Venus, in Virgo, is, of course, an evening star, too, but is just as badly placed as Mercury. Mars and Jupiter are close to the western horizon at dusk, while Saturn, Uranus, and Neptune are quite invisible. Hence, as far as the planets are concerned, the night sky is a blank. The moon is new at 4h. 56.1m. A.M. on the 6th, enters her first quarter at 9h. 59.9 P.M. on the 12th, is full at 5h. 24.3m. A.M. on the 20th, and enters her last quarter at 8h. 30.2m. A.M. on the 28th. Four occultations of fixed stars by the moon will happen at convenient hours for the amateur observer during September. The first occurs on September 1, when the 6th magnitude star 61 Geminorum will disappear at the moon's bright limb 4m. after midnight at an angle of 84° from her vertex. It will reappear

at her dark limb at 12h. 50m. at an angle from her vertex of 216°. The second is on September 14, on the night of which at 10h. 58m., 50 Sagittarii, of the 6th magnitude, will disappear at the dark limb of the moon at an angle from her vertex of 134°; she will though have set prior to its reappearance. Thirdly, on the 16th, 30 Capricorni will disappear at her dark limb at 9h. 47m. P.M., at an angle of 128° from the vertex of the moon, and will reappear at her bright limb at 11h. 1m. P.M. at a vertical angle of 28°. Finally, on the 28th, before the moon rises, she will have occulted ζ^2 Geminorum of the 4th magnitude. Its reappearance may be observed later on at 11h. 11m. P.M. at her dark limb, at an angle of 245° from her vertex. When our notes begin the moon is in Gemini ("The Seasons Pictured," plate xxiv.), through which she is travelling until 2h. 30m. P.M. on the 2nd, at which hour she enters Cancer. She remains in Cancer until 4h. A.M. on the 4th, and then passes into Leo. Her journey through Leo occupies her until 6h. P.M. on the 6th, when she crosses into Virgo ("The Seasons Pictured," plate xxv.). It is not until 7h. P.M. on the 9th that her passage through this great constellation is completed, and she has entered Libra ("The Seasons Pictured," plate xxvi.). Travelling over Libra she arrives at 11h. 30m. A.M. on the 11th on the western edge of the narrow northern spike of Scorpio, which she has crossed by 8h. 30m. the same evening and emerged in Ophiuchus. She leaves Ophiuchus at 9h. A.M. on the 13th, and enters Sagittarius. There she remains until 5 P.M. on the 15th, when she leaves it in turn for Capricornus ("The Seasons Pictured," plate xxi.). At 3h. 30m. P.M. on the 17th she quits Capricornus for Aquarius. Her passage over Aquarius terminates at 4h. 30m. P.M. on the 19th, when she enters Pisces ("The Seasons Pictured," plate xxii.). In the course of her journey across Pisces she passes into a part of Cetus at noon on the 20th, in which constellation she continues until 7 P.M. on the 21st, re-emerging in Pisces at the hour last named. It is only, however, to plunge into another outlier of Cetus twenty-four hours later (*i.e.*, at 7h. P.M. on the 22nd), and, when she finally quits this at 8 A.M. on the 23rd, it is to come out in Aries ("The Seasons Pictured," plate xxiii.). By 2h. P.M. on the 24th she has traversed Aries, and quitted it for Taurus. In the course of her journey through Taurus she arrives at 6h. 30m. P.M. on the 27th on the boundary of the most northerly portion of Orion. It takes her until 2h. 30m. A.M. on the 28th to cross this, and when she has done so she comes out in Gemini ("The Seasons Pictured," plate xxiv.). She passes out of Gemini into Cancer at 11h. 30m. P.M. on the 29th. There we leave her at midnight on the 30th.

A REMARKABLE RIDE.—Mr. Chas. Hill, of the Finchley Harriers, on August 10, accomplished a remarkable ride on a "Geared Facile" bicycle, having ridden no less than 293 miles in the 24 hours, only 2 miles less than the record standing to the credit of Mr. G. P. Mills, and 21 miles more than all other previous performances. This splendid ride, on the hottest day we have had this year, is a great performance for both man and machine, more especially in view of the fact that Mr. Hill had only ridden a "Facile" for a month previously to the start. He rode the same machine throughout—a 46-inch, geared to 69 inches, weighing about 36 lbs., and is quite confident that with all circumstances favourable he can cover over 300 miles in 24 hours on a "Geared Facile," of which he speaks in the highest terms.

Our Whist Column.

BY "FIVE OF CLUBS."

THE solution of Mr. Lewis's double dummy problem (see January Number of KNOWLEDGE) is as follows. We repeat the problem for the reader's convenience:—

THE HANDS.

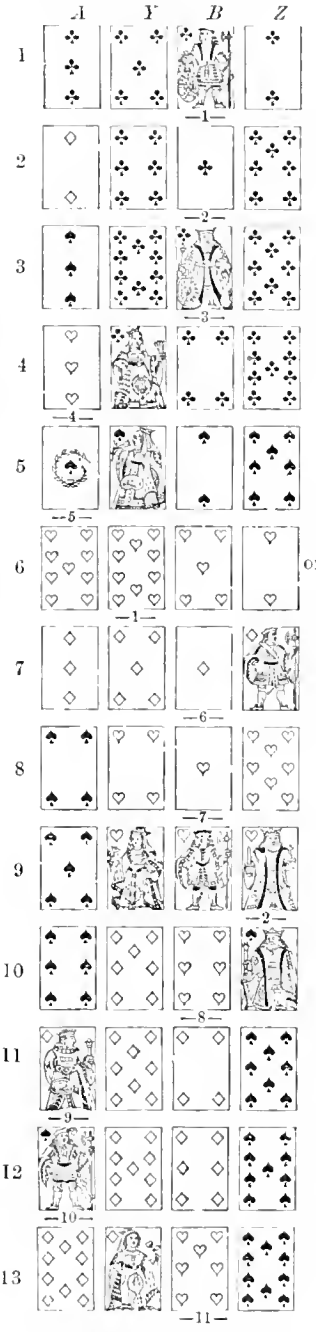
B { H. (*trumps*).—A, Kn, 8, 6, 5. C.—A, K, Kn, 4.
S.—2 D.—A. 6, 4. }

Y { H. (*trs.*).—Q, 10, 4. H. (*trs.*).—K, 7, 2.
S.—Q. S.—K, 10, 9, 8, 7.
C.—Q, 10, 6, 5. C.—9, 8, 7, 2.
D.—Q, 9, 8, 7, 5. D.—Kn. } *Z*

B / Y Z / *Tr.* Hearts / A leads

A { H. (*trumps*).—9, 3. C.—3.
S.—A, Kn, 6, 5, 4, 3. D.—K, 10, 3, 2. }

Hearts are trumps. A leads. How many tricks can A-B make against the best defence?



A and B make five by tricks.

*	A	Y	B	Z
6	H 9	H 4	H 5	H K
7.	S 4	H 10	H Kn	S 7
8.	D 3	D 5	D A	D Kn
9.	D 10	H Q	H A	H 2
10.	S 5	D 7	H 7	H 8
11.	S 6	D 8	H 6	S K
12.	D K	D 9	D 4	S 9
13.	S Kn	D Q	D 6	S 10

NOTES.

It will be seen on a careful study of the position that for full success A and B must make one trick by ruffing Clubs, while Y and Z must be prevented from making Trumps by ruffing. Further, either Z must be compelled to lead Spades after the Ace is out, or Y to lead a Diamond after Ace is out and Trumps are exhausted. Everything then depends on rightly placing the lead when Y's and Z's trumps are out. By the line of play indicated above A and B clear out the Clubs from Y-Z's hands, so that every lead must now necessarily be from Diamonds or Spades when Trumps are out. Moreover, by leading the Spade Ace at trick 5, A clears Y of Spades also. Note the effect of omitting this lead. Y covering the Heart Nine will lead a small Diamond, which either A or B must win. If A wins, he has no better course than to lead Spade Ace, following with a small one, which Y will trump with the Queen, after which, no matter how B may play, Y-Z must make two more tricks in trumps. (The same result must follow if B wins the first round of Trumps as actually played above.) If B, on the contrary, wins, he must then take out two rounds of Trumps as his best chance; and Y-Z will be able to get rid of the lead by leading a Spade, and thus make a Spade or a Diamond, besides two Trump tricks.

In fact, A has to lead out the Spade Ace to prevent the lead being forced into his hand; and B must, in like manner, lead out, or get out (according to his position) the Diamond Ace before drawing the second round of Trumps. Thus, if Y leads a Trump at trick 7, B wins with the Ace, leads Diamond Ace, and then goes on as above with Heart Knave.

If, in this variation, Y discards a Diamond at trick 7, B wins the trick with Heart 6, then leads out in succession Diamond Ace, Heart Ace, and Heart Knave. On this, if Z at trick 9 should throw Heart King to the Ace, to allow Y to win trick 10, then A must discard a Spade instead of a Diamond at trick 9. Otherwise the game will run as before.

Our Chess Column.

By "MEPHISTO."

GAMES PLAYED IN THE TOURNAMENT OF THE B.C.A. AT BRADFORD.

White. Mr. Blackburne.	Black. Mr. Lee.	White. Mr. Blackburne.	Black. Mr Lee.
1. P to K4	P to K3	28. Q to Qsq	B to Qsq
2. P to Q4	P to Q4	29. Q to Q2	B to R4
3. Kt to QB3	Kt to KB3	30. K to B2	B × B
4. P to K5 (*a*)	KKt to Q2	31. KR × B	R × R
5. P to KB4	P to QB4	32. R × R	R × R
6. P × P (*b*)	B × P	33. Q × R	Q to B5
7. Q to Kt4 (*c*)	P to KKt3 (*d*)	34. Q × Q (*j*)	P × Q
8. Kt to KB3	Kt to QB3	35. K to K3	K to B3
9. B to Q3 (*e*)	Kt to Kt5	36. K to K4	P to Kt4
10. B to Q2	Kt to Kt3	37. P to Q5(ch) (*k*)	P × P (ch)
11. P to R3	Kt × B (ch)	38. K to Q4	P to KR5
12. P × Kt	B to Q2	39. P to KR3	P to R4
13. R to QBsq	R to QBsq	40. P to B5	P × P
14. Q to R3	Kt to R5 (*f*)	41. P to K6	K to Q3
15. Kt × Kt	B × Kt	42. P × P	K to K2
16. P to Q4	B to K2	43. P to Kt6	P to B5
17. Castles	B to B7 (*g*)	44. K to B3	P to Kt5 (ch)
18. B to B3	B to KB4	45. P × P	P × P (ch)
19. P to KKt4 (*h*)	B to Q6	46. K to Q4	K to Bsq
20. KR to Ksq	R to B3	47. K to K5	K to K2
21. Kt to Q2	B to B5	48. K × BP	P to B6
22. R to K3	P to KR4	49. P × P	P to Kt6
23. Kt to Bsq	K to Q2 (*i*)	50. K to Kt5	P to Kt7
24. P to Kt5	B × Kt	51. K to R6	P Queens
25. Q × B	Q to Kt3	52. K to Kt7	Q to Ktsq
26. Q to Qsq	KR to QBsq	53. K to R7	K to B3
27. Q to R4	Q to R3	Resigns.	

NOTES.

(*a*) Some players prefer this continuation to 4. B to KKt5, the German masters (recently) in particular.

(*b*) This was played by Steinitz *v.* Golmayo, at Havanna.

(*c*) As played by the late Dr. Zukertort against Gunsberg, in this year's Hardicap of the British Chess Club.

(*d*) Pollock considers that Black can risk Castling at this juncture, P to KB4 being an important feature in the defence.

(*e*) The QB ought to be played first, as the placing of the other B on Q3, where it can be at once attacked by the Knight, is not advantageous for White.

(*f*) This move simplifies the game in Black's favour.

(*g*) Bringing his Bishop into a better position presently.

(*h*) It is always hazardous to expose the King in this way as long as the opponent has two Bishops on the board.

(*i*) Threatening, with good judgment, to open the Rook's file.

(*j*) After all these exchanges White is found to have suffered in position, solely due to the fact that he attempted to avoid the drawing line of play, which his adversary seemed bent to force upon him.

(*k*) Black has the opposition, and would soon be able to gain the Queen's Pawn, having various moves at his disposal, in order to gain time, and thus compel the White King to abandon the defence of that Pawn. Seeing this, White adopts the masterly but desperate course of sacrificing that Pawn at once, and others subsequently, the ingenious combination, however, being frustrated by Black's accurate play.

EVANS'S GAMBIT REFUSED.

Pollock.	Mason.
1. P to K4	P to K4
2. KKt to B3	QKt to B3
3. B to B4	B to B4
4. P to QKt4	B to Kt3
5. P to B3	Kt to B3
6. P to Q3	P to Q3
7. B to KKt5	P to KR3
8. B to R4	P to KKt4
9. B to KKt3	

Up to the present the game calls for no comment. In similar positions the Knight can sometimes be sacrificed, but it will not do here, supposing 9. Kt × P, P × Kt; 10. B × P, B × P (ch)!; 11. K × B (if K to Bsq, B to R5), Kt × P (ch), with the better game.

	Kt to K2
10. Q to Kt3	

In order to induce Black to Castle,

	Castles
11. QKt to Q2	Kt to Kt3
12. P to KR4	P to Kt5
13. P to R5	Kt to B5
14. B × Kt	P × B
15. Kt to R4	P to B3

To guard against the loss of the exchange. For if White (after P to B3) should play Kt to Kt6, Black would reply with P to Q4, gaining two pieces for his Rook.

16. Q to B2	P to Q4
17. B to Kt3	P to R4
18. P × RP	B × P
19. Cas. to QR	B to K3
20. P to Q4	R to Bsq
21. P to K5	Kt to R2

If Black plays Kt × P, White might revive his attack against the King's side. The White Rook's Pawn is more of a protection to Black; moreover, it is bound to fall in the end game.

22. Kt to B5	

Kt to Kt6 is a much superior move, viz., 22. Kt to Kt6, P × Kt; 23. Q × P(ch.), K to Rsq; 24. Q × B, B × P; 25. Kt to Kt sq; with better attacking chances than occurred in the actual game. Of course, if Black refuse to take the Kt on the 22nd move, but plays R to Ksq instead, White simply replies 23. Kt × BP.

	Q to Kt 4
23. Kt to Q6	P to QB4

A very fine and undoubtedly preconceived operation.

24. Kt × R	R × Kt
25. P to QB4?	BP × P
26. B to R4	B × Kt(ch.)
27. K × B	R × P
28. Resigns *	

FOUR KNIGHTS' DEFENCE.

White. A. Burn.	Black. J. Mortimer.	White. A Burn.	Black. J. Mortimer.
1. P to K4	P to K4	9. Kt to Kt3	B to KKt5
2. Kt to KB3	Kt to KB3	10. P to KR3	B to K3
3. Kt to QB3	Kt to QB3	11. B to Kt5	P to KR3
4. B to Kt5	B to Kt5	12. B to R4	P to KKt4
5. Castles.	Castles.	13. Kt × P	P × Kt
6. P to Q3	P to Q3	14. B × P	Q to Q2
7. B × Kt	P × B	15. B × Kt	B × RP
8. Kt to K2	B to QR4	16. Q to KR5	Resigns

* If 28. Q to Kt3, P to B6(ch.); 29 K to Ksq, P × P; 30. KR to Kt sq, Q × P(ch.); 31. K to Q2, Kt to Kt4! and wins.

THE LOISETTE SYSTEM.—Mr. G. S. Fellows, M.A., published in New York a pamphlet claiming to contain "Loisette's Complete System of Memory," and proves (as an excuse for printing) that Professor Loisette's System was not original. The question was tried in the Supreme Court of New York, before Chief Justice Vambrunt, on July 26, 1888. Dr. William A. Hammond, author of several works on the mind and the nerves; Daniel Greenleaf Thompson, author of "A System of Psychology" (Longmans, 1884), and others, testified that the Loisettian System is original, being a new departure in the education of the Memory, and is of great value. The Supreme Court made perpetual an injunction restraining Mr. Fellows from publishing his pamphlet, and ordered him to deliver to Professor Loisette the stereotype plates and books. The pamphlets delivered up numbered over 9,000.

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